ARMY ORDNANCE

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Pledged to Industrial Preparedness as Our Strongest Guaranty of Peace

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The Army Ordnance Association

THE Army Ordnance Association is a national organization of American citizens pledged to industrial preparedness for war as our nation's strongest guaranty of peace.

The Association endeavors to keep alive an interest in and knowledge of the design, production and maintenance of munitions. Other than a few manufacturing arsenals—six in all—there is no peace-time industry for the production of ordnance. Should war unhappily come again, industrial America will be called upon to produce munitions in great quantity and of intricate and unusual design. In an emergency, time will not permit careful study or long preparation for the production of munitions. The problem is one of vital concern.

The Army Ordnance Association believes that the solution of this problem, based on experience, lies in an active organization at all times coöperating with the Government. The principal objective of the Association is an active membership of American citizens, on whom the duty of design and production of munitions will fall in war, who will have an accurate and authentic knowledge of the complex requirements of ordnance. "Peace insurance" in this form is the foremost aim of the Army Ordnance Association.

The Association is devoted solely to the national defense; it has no commercial interests, no political alliances, and no religious affiliations. It is not operated for profit: its income is expended in furthering its aims. Its officers and directors serve without remuneration. Membership, to which American male citizens are eligible, is four dollars a year. (Application on request.)

ARMY ORDNANCE, the journal of the Association, is published solely for the purpose of disseminating information on the progress of our munitions developments so that American industry may at all times know its responsibilities to the common defense.

The objectives of the Association as set forth in its Constitution are:

To assist in effecting industrial preparedness for war as being one of the nation's strongest guaranties of peace;

To keep available the highly specialized knowledge necessary for arming the manhood of the nation by stimulating interest in the design and production of ordnance material;

To promote mutual understanding and to effect coöperation with American scientists, inventors, engineers and manufacturers in civil life and the Regular and Reserve officers of the Ordnance Department;

To provide, when required, the services of competent committees to investigate and report upon special ordnance subjects;

To assist in developing and maintaining an efficient personnel, both commissioned and enlisted, for the units required for Ordnance Field Service in the event of an emergency;

To commemorate the services rendered by the industry of the nation and by the officers and civilian employees of the Ordnance Department in the wars in which the United States has been engaged.

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PREPAREDNESS is as necessary today as it was for us when war was declared in 1917, and we find ourselves in practically the same condition. Congress has made certain appropriations for matériel, but that is far short of what I think America must do. Every energy in this country should be devoted to the idea of putting the United States in a condition of thorough preparedness against the possibility of war.

NONE OF US can tell when we may become involved in the struggle now raging with such tremendous fury in Europe. In my opinion, the very life of this Republic depends on the energy and determination with which our people undertake the task of placing the United States in a state of thorough preparation in both men and equipment.

THE TIME FACTOR should be the dominant consideration. In 1917, I sailed for Europe with nothing material available other than the will to do and a hasty plan as the basis for doing it. Our allies protected us during more than a year of preparation. They provided us with the matériel. Today the situation is utterly different. This great country must, within itself, be prepared for whatever instant action is required for our security. We must not delay longer in our preparations.

JOHN J. PERSHING
General of the Armies

May 15, 1940

ARMY ORDNANCE

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National Protection

*The President's Armament Program**

THESE are ominous days—days whose swift and shocking developments force every neutral nation to look to its defenses in the light of new factors. The brutal force of modern offensive war has been loosed in all its horror. New powers of destruction, incredibly swift and deadly, have been developed, and those who wield them are ruthless and daring. No old defense is so strong that it requires no further strengthening, and no attack is so unlikely or impossible that it may be ignored. Let us examine, without self-deception, the dangers which confront us. Let us measure our strength and our defense without self-delusion.

The clear fact is that the American people must recast their thinking about national protection. Motorized armies can now sweep through enemy territories at the rate of 200 miles a day. Parachute troops are dropped from airplanes in large numbers behind enemy lines. Troops are landed from planes in open fields, on wide highways, and at local civil airports. We have seen the treacherous use of the "fifth column" by which persons supposed to be peaceful visitors were actually a part of an enemy unit of occupation. Lightning attacks, capable of destroying airplane factories and munition works hundreds of miles behind the lines, are part of the new technique of modern war. The element of surprise which has ever been an important tactic in warfare has become the more dangerous because of the amazing speed with which modern equipment can reach and attack the enemy's country.

Our own vital interests are widespread. More than ever the protection of the whole American Hemisphere against invasion or control or domination by non-American nations has the united support of the twenty-one American Republics, including the United States. More than ever this protection calls for ready-at-hand weapons capable of great mobility because of the potential speed of modern attack.

The Atlantic and Pacific Oceans were reasonably adequate defensive barriers when fleets under sail could move at an average speed of five miles an hour. Even then by a sudden foray it was possible for an opponent actually to burn our National Capitol. Later, the oceans still gave strength to our defense when fleets and convoys propelled by steam could sail the oceans at fifteen or twenty miles an hour.

But the new element—air navigation—steps up the speed of possible attack to 200, to 300, miles an hour. Furthermore, it brings the new possibilities of the use of nearer bases from which an attack or attacks on the American Continents could be made. From the fiords of Greenland it is 4 hours by air to Newfoundland; 5 hours to Nova Scotia, New Brunswick, and Quebec, and only 6 hours to New England. The Azores are only 2,000 miles from parts of our eastern seaboard, and if Bermuda fell into hostile hands it is a matter of less than 3 hours for modern bombers to reach our shores. From a base in the outer West Indies, the coast of Florida could be reached in 200 minutes. The islands off the west coast of Africa are only 1,500 miles from Brazil. Modern planes starting from the Cape Verde Islands can be over Brazil in 7 hours. And Para, Brazil, is but 4 flying hours to Caracas, Venezuela; and Venezuela but 2½ hours to Cuba and the Canal Zone; and Cuba and the Canal Zone are 2¼ hours to Tampico, Mexico; and Tampico is 2½ hours to St. Louis, Kansas City, and Omaha.

On the other side of the continent, Alaska, with a white population of only 30,000 people, is within 4 or 5 hours of flying distance to Vancouver, Seattle, Tacoma, and Portland. The islands of the southern Pacific are not too far removed from the west coast of South America to prevent them from becoming bases of enormous strategic advantage to attacking forces.

SURELY the developments of the past few weeks have made it clear to all of our citizens that the possibility of attack on vital American zones ought to make it essential that we have the physical, the ready, ability to meet those attacks and to prevent them from reaching their objectives. This means military implements—not on paper—which are ready and available to meet any lightning offensive against our American interest. It means also that facilities for production must be ready to turn out munitions and equipment at top speed.

We have had the lesson before us over and over again—nations that were not ready and were unable to get ready found themselves overrun by the enemy. So-called impregnable fortifications no longer exist. A defense which allows an enemy to consolidate his approach without hindrance will lose. A defense which makes no effective effort to destroy the lines of supplies and communications of the enemy will lose. An effective defense, by its very nature, requires the equipment to attack an aggressor on his route before he can establish strong bases within the territory of American vital interests.

Loose talking and thinking on the part of some may give the false impression that our own Army and Navy are not first-rate or that money has been wasted on them. Nothing could be further from the truth. In recent years the defensive power of our Army, Navy, and Marine Corps has been very greatly improved. The Navy is stronger today than at any time in the nation's history. Today also a large program of new construction is well under way. Ship for ship, ours are equal to or better than the vessels of any foreign power.

*Address of the President of the United States to Congress, May 16, 1940.

The Army likewise is at its greatest peace-time strength. Its equipment in quality and quantity has been greatly increased and improved. The National Guard and the Reserve strength of the two services are better equipped and better prepared than during any other peace-time period.

On the other side of the picture we must visualize the outstanding fact that, since the first day of September 1939, every week that has passed has brought new lessons learned from actual combat on land and sea. I cite examples: Where naval ships have operated without adequate protection by defending aircraft, their vulnerability to air attack has increased. All nations are hard at work studying the need of additional antiaircraft protection. Several months ago the use of a new type of magnetic mine made many unthinking people believe that all surface ships were doomed. Within a few weeks a successful defensive device against these mines was placed in operation; and it is a fact that the sinkings of merchant ships by torpedo, by mine, or by airplane are definitely much lower than during the similar period in 1915.

COMBAT conditions have changed even more rapidly in the air. With the amazing progress in the design of planes and engines, the airplane of a year ago is out of date now. It is too slow, it is improperly protected, it is too weak in gun power. In types of planes we are not behind the other nations of the world. Many of the planes of the belligerent powers are at this moment not of the latest models. But one belligerent power not only has many more planes than all its opponents combined, but also appears to have a weekly production capacity at the moment that is far greater than that of its opponents.

From the point of view of our own defense, therefore, great additional production capacity is our principal air requisite. For the permanent record, I ask the Congress not to take any action which would in any way hamper or delay the delivery of American-made planes to foreign nations which have ordered them or seek to purchase more planes. That, from the point of view of our own national defense, would be extremely short-sighted. During the past year, American production capacity for war planes, including engines, has risen from approximately 6,000 planes a year to more than double that number, due in greater part to the placing of foreign orders. Our immediate problem is to superimpose on this production capacity a greatly increased additional production capacity. I should like to see this nation geared up to the ability to turn out at least 50,000 planes a year. Furthermore, I believe that this nation should plan at this time a program that would provide us with 50,000 military and naval planes.

The ground forces of the Army require the immediate speeding up of last winter's program to procure equipment of all kinds, including motor transport and artillery, including antiaircraft guns and full ammunition supplies. It had been planned to spread these requirements over the next three or four years. We should fill them at once.

At this time I am asking the immediate appropriation by the Congress of a large sum of money for four primary purposes: First, to procure the essential equipment of all kinds for a larger and thoroughly rounded out Army; second, to replace or modernize all old Army and Navy equipment with the latest type of equipment; third, to increase production facilities for everything needed for the Army and Navy for national defense. For it is clear that we require the ability to turn out quickly infinitely greater supplies; fourth, to speed up to a 24-hour basis all existing Army and Navy contracts, and all new contracts to be awarded.

I ask for an immediate appropriation of $896,000,000, and may I say that I hope there will be speed in giving the appropriations. That sum I would divide approximately as follows: (1) For the Army, $546,000,000; (2) for the Navy and Marine Corps, $250,000,000; (3) to the President, to provide for emergencies affecting the national security and defense, $100,000,000. . . .

(EDITOR'S NOTE.—In a subsequent message by the President, these amounts were increased by a total of approximately one billion dollars, and the combined requests were speedily approved by the Congress. While much of the additional money is for ordnance equipment, the exact allocations are not available as this issue goes to press.)

THERE are some who say that democracy cannot cope with the new techniques of government developed in recent years by some countries—by a few countries which deny the freedoms which we maintain are essential to our democratic way of life. This I reject.

I know that our trained officers and men know more about fighting and the weapons and equipment needed for fighting than any of us laymen; and I have confidence in our officers and men. I know that to cope with present dangers we must be strong in heart and mind; strong in our faith—strong in faith in our way of living.

I, too, pray for peace—that the ways of aggression and force may be banished from the earth—but I am determined to face the fact realistically that this nation requires also a toughness of moral and physical fiber. Those qualities, I am convinced, the American people hold to a high degree.

Our task is plain. The road we must take is clearly indicated. Our defenses must be invulnerable, our security absolute. But our defense as it was yesterday, or even as it is today, does not provide security against potential developments and dangers of the future. Defense cannot be static. Defense must grow and change from day to day. Defense must be dynamic and flexible, an expression of the vital forces of the nation and of its resolute will to meet whatever challenge the future may hold. For these reasons I need hardly assure you that after the adjournment of this session of Congress I will not hesitate to call the Congress into special session if at any time the situation of the national defense requires it. And the Congress and the Chief Executive constitute a team where the defense of the land is concerned.

Our ideal, yours and mine—the ideal of almost every man, woman and child in the country—our objective is still peace—peace at home and peace abroad. Nevertheless, we stand ready not only to spend millions for defense but to give our service and even our lives for the maintenance of our American liberties.

Our security is not a matter of weapons alone. The arm that wields them must be strong, the eye that guides them clear, the will that directs them indomitable. These are the characteristics of a free people, a people devoted to the institutions they themselves have built, a people willing to defend a way of life that is precious to them all, a people who put their faith in God.

The Military Armament Program

The following data were presented by Gen. George C. Marshall, Chief of Staff, U. S. Army, to the Appropriations Committee of the United States Senate on May 22, 1940. They show the critical items of armament on hand May 1, 1940 and originally scheduled to be on hand upon completion of the program (fiscal years 1940 and 1941). These latter figures, in many cases, subsequently were revised upward.

Type of equipment	*On hand May 1, 1940*	*Will be on hand at completion of program*
ANTIAIRCRAFT		
3-inch guns	448	500
90-mm. guns		317
Directors	168	273
Height finders	142	276
Sound locators	194	801
37-mm. guns, antiaircraft	15	1,423
Machine gun, caliber .50	1,014	1,682
SMALL ARMS		
Semiautomatic rifles	38,000	240,559
37-mm. antitank guns	228	1,388
60-mm. mortars	3	3,756
81-mm. mortars	183	853
Machine gun, caliber .50 (pack)	83	962
FIELD ARTILLERY MATÉRIEL		
75-mm. gun, modernized	141	1,432
75-mm. howitzer (field and pack)	90	319
105-mm. howitzer		120
155-mm. gun, long-range	4	96
8-inch howitzer		48
COMBAT VEHICLES		
Scout cars	485	1,346
Combat cars	114	208
Tanks, light M2A4	10	734
Tanks, medium M2	18	194
TRACTORS AND SPECIAL ORDNANCE VEHICLES		
Tractors, light	93	120
Tractors, medium	261	550
Tractors, heavy	65	777
Trucks, small-arms repair	79	146
Trucks, instrument repair		53
RAILWAY ARTILLERY		
8-inch railway gun and carriage		24
AMMUNITION		
Bomb, 500-pound	11,928	34,924
Bomb, 1,000-pound	4,336	14,511
Caliber .30 armor-piercing	17,268,000	73,920,000
Caliber .50 ball	25,220,000	53,117,000
37-mm. tank and antitank	75,000	1,205,000
37-mm. antiaircraft gun	46,000	2,624,000
81-mm. mortar	43,000	373,000
75-mm. howitzer, high-explosive	142,000	382,500
155-mm. howitzer, high-explosive	925,000	1,131,000
8-inch howitzer, high-explosive		29,000
ENGINEER CORPS		
Ponton bridge, 10-ton	1	32
Ponton equipage, 23-ton	1	8
Water-purification unit	4	45
Searchlight, 60-inch mobile	285	1,028
CHEMICAL WARFARE		
Gas masks	407,696	1,297,000

AIRPLANES	*Combat*	*Training*	*Miscellaneous*
Aviation Expansion Program	3,300	2,073	127
War Department appropriations, 1941	109	37	20
Supplemental appropriations, 1941	200	2,200	
Total	3,609	4,310	147

Clausewitz—A Century After

A Doctrine of the Past in the Light of the Present

By Hoffman Nickerson*

GEN. KARL VON CLAUSEWITZ, whose untimely death took place over a hundred years ago, is still the great theorist and philosopher of war. In 1917, America's most distinguished military historian, R. M. Johnston, wrote in his "Clausewitz to Date": "The supremacy of Clausewitz in the domain of military theory remains unchallenged . . . To what . . . does he owe this enduring supremacy? Wholly to the solidity of his foundation stones . . ."

Those who would analyze and understand armed conflict cannot do better than start from his clear and accurate generalizations. After three crowded generations of experience, those generalizations remain as true as when first written, so that any criticism of the great Prussian, however destructive, must take the form of comment upon and modification of his work rather than of an attempt to lay new foundations for military thought.

This article will comment briefly upon three closely related matters: (1) Clausewitz' classification of military objectives, (2) the true meaning of the military term "destruction" in such phrases as "the destruction of an armed force," and (3) the object of war itself.

Having defined war as a political act—"a continuation of policy by other means"—and therefore always subservient to the political end in view, and having distinguished between "limited" and "unlimited" wars, Clausewitz goes on to consider military objectives as follows: "In the conduct of war there are three principal objects: (1) to conquer and destroy the enemy's armed force, (2) to seize his material resources and other sources of existence of the hostile army, and (3) to gain public opinion." The principal operation always should be directed against the enemy's main army, after the defeat of which his material resources could be seized and opinion would be gained.

What are we to make of this in the light of subsequent warfare? Certain wars since Clausewitz' time have indeed been decided in this way. The Austro-Prussian War of 1866 and the Franco-Prussian War of 1870 follow the classic pattern. In 1866, the main Austrian army, although not destroyed, was nevertheless defeated and compelled to a considerable retreat, followed by peace within seven weeks of the declaration of war. In 1870, almost all the units of the French regular army, the only trained and organized land forces of the country, were within four weeks either "destroyed" in a military sense—most of them being captured—or were closely besieged in the eastern French fortresses at some distance from the new theater of war in which hastily raised French levies were ineffectively struggling with the invader. In both cases prompt victory in the field determined, or at least went a long way toward determining, the final result.

On the other hand there have been other cases which this classification of objectives did not fit at all. In the American Civil War the exhaustion of Southern resources accompanied a series of battles in which the smaller Southern armies gradually lost ground, first in the West and then in Georgia, while the main land forces of both combatants were still deadlocked in Virginia. These battles and the subsequent occupations of territory were not the only means by which the Confederacy was worn down—another means was blockade; and not until the exhaustion of the Southern home front were the Confederate armies forced to surrender.

In the Russo-Japanese War the Japanese pushed back the main Russian army in Manchuria without being able to defeat it decisively, still less to destroy it, and toward the end the Russians were becoming relatively stronger when the threat of internal revolution forced their government to make peace. Most conspicuous of all, the land campaigns of 1914-1918 long remained indecisive. It is at least possible to argue that, even in the autumn of 1918, if the morale of the German people had not cracked under the strain of blockade and of hope long deferred and finally extinguished, and if the breaking of the home front had not weakened the morale of the German Army, then that army might have held out considerably longer. Neither in the Civil War nor in 1905 nor in 1918 was a decision achieved by fighting alone without the addition of economic or political pressure. Neither Germany nor the Anglo-French alliance even attempted to gain a decision by battle during the first phase of the present war.

Turning to naval warfare, the Clausewitzian classification of objectives is wholly inapplicable. However desirable the destruction of the enemy's battle fleet and of his other organized naval forces may be, one cannot attempt it directly unless he offers battle. If he keeps his ships in harbor, threatening to put to sea but not doing so, there is no way to destroy them except by attacking his ports. Such an attack was practically always a land operation and today would be attempted on land and in the air. As far as direct encounter between navies is concerned, battles must largely depend upon mutual consent.

MUCH the same thing is true of air warfare: when an enemy keeps his airplanes on the ground they cannot be forced to battle. On the ground they may be vulnerable, as the Polish Air Force was last September, but on the other hand they may be as completely sheltered as a fleet in a fortified harbor is sheltered against naval attacks. For instance, the Germans are said to have put a number of their hangars underground. Aircraft factories, too, can be strongly fortified. Further, the chances of catching an enemy who has ventured out and is returning homeward are even less than in naval surface warfare because of the great speed of airplanes together with the opportunities for evasion offered by a tridimensional field of operation such as the air.

How then are we to modify Clausewitz' classification of

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objectives? Here as always his thought was saturated with his own experience—with the great events and sudden transformation of war in the Revolutionary-Napoleonic period. In spite of his broad knowledge of military history and his love for rational principles, concrete "practical" cases were always first in his mind. Ironically enough, had he been less "practical" and more philosophical his conclusions would need less rearrangement today.

In the first place he thought of resources, "material, and other sources of existence" of the armed forces, chiefly in terms of depots of weapons and ammunition. These depots would ordinarily be covered by the hostile army so that they could not be seized without defeating it. Also when he thought of war he considered particularly the rapid marches and resounding victories of Napoleon's best period, with an occasional side glance at the more spectacular campaigns of Frederick the Great. As a child of his time he could not have escaped the romantic-naturalist movement of thought with its emphasis upon emotional thrills. We easily pardon an early-nineteenth-century Prussian for being a little dazzled by Napoleon, but we must admit that he insufficiently considered both blockade and position warfare. Nor did he foresee from Napoleon's bulletins and proclamations the beginning of the direct and systematic attack upon opinion for military purposes which today we call propaganda.

The factors making for wars of position and blockade are not far to seek. In the last century, population and total wealth have grown enormously. At the same time the authority of governments has correspondingly increased, while the system of banking and credit makes a hitherto unknown proportion of the resources of the community immediately available for war. We may add the moral force of national patriotism which has made the government of one's country almost a god. Since the planet remains the same size, these various forces have combined to produce armies so large that they fill entire theaters of operations. Cramped between natural obstacles such as seas or between neutral frontiers—which cannot always be violated with impunity—two such armies cannot maneuver. They can only meet head on and pound at each other. When to the defensive strength of modern fire power there is added the modern ability to fill vast zones with complex fortifications, entire wars begin to resemble sieges. In these circumstances, even such effective means of rapid movement as the airplane and the tank seem unlikely to counteract the tendency toward immobility.

Now sieges always have been decided by exhaustion, and in all normal cases they must continue to be. Strong defensive works, well supplied and adequately garrisoned by troops in good heart, cannot be rushed. Their defenders cannot be "destroyed" by a single blow as sometimes can be given to a defeated force in the open. They must be worn down before a decision can be reached, and this is often a long process requiring great efforts by the besiegers. Accordingly, all intelligent and active siege work aims to exhaust the besieged as quickly as that can be done without ruinous loss and expenditure to the attacking side. The principle is most clearly illustrated in the writings of Vauban. At the same time, the besieger also can use the passive means of blockade. If he can completely surround the defended area he need only hold his lines and wait until the foodstuffs and other supplies necessary to support life within that area are consumed.

Within the last century, conditions not only have furnished the means of blockading large areas—they also have made many such areas vulnerable to blockade. Modern transportation has accustomed civilized people to the daily use of and to dependence upon articles produced at great distances from the places where they are consumed. We need think only of mineral oil and gasoline, of tropical products like coffee and rubber, and of the need to import food for industrial populations. Further, modern nations are so highly organized for war that even a general mobilization without fighting is enough to set up a sort of self-imposed blockade. So much labor power and so much revenue is directly and indirectly subtracted from civilian use that an economic strain like that of a mild blockade results even when no true blockade can be achieved by the enemy. Thus a hostile blockade finds the beginning of its task—often a considerable beginning—already accomplished before it begins to act. To use Clausewitzian terms, blockades are positive acts because in a sense they "seize the enemy's resources." In the long run, therefore, they destroy his armed forces indirectly by destroying the "sources of existence" of those forces. Nevertheless, this sort of "destruction" is very different from the immediate destruction of one armed force by another through a crushing victory in combat. So elastic a use of terms leads to confused thinking, and in the conduct of war clear thinking is superlatively desirable.

SUPPOSE, then, that we retain Clausewitz' three objectives —the enemy's armed and organized forces, the physical resources which are the sources of his power, and the gaining of opinion—but reverse the order. Suppose we say that in the last analysis all acts of war are intended to change the enemy's opinion—in other words to persuade him to surrender and to destroy his courage so that he will submit to our will. This might apply even to extreme cases ending in extermination. Courage might be so destroyed that the surviving individuals of the defeated side would not even have the moral energy to sell their lives dearly. Indeed, certain eminent students of war have thought that this was the normal course of ancient battles: when once the formation of one side was broken, there followed a general massacre of fugitives who offered little resistance.

To all other cases, the idea that the gaining of opinion by the destruction of the enemy's courage is the ultimate object of war applies clearly enough. The direct attack upon opinion by means of propaganda is of this sort. For instance, Allied propaganda as to horrible German losses at Verdun in 1916 ended by impressing even the German people, although the real German losses were less than those of the French in proportion of about three to five. Propaganda addressed to one's own people is intended to have the converse effect of preventing the destruction of their courage, and when addressed to neutrals it seeks to persuade them that one's victory is both probable and desirable. All other military acts may be called indirect attacks upon opinion. Whether we seek to seize the enemy's resources or to deprive him of them by blockade, or whether we try to put armed forces out of action by "destroying" them in a military sense, what we are really attacking is the determination of his government and people. Once that determination is gone, we have won. War under present conditions is better understood in this way.

Nevertheless the "destruction" of the hostile armed forces remains the most desirable means of destroying the courage

of the hostile government and people, when and if it be both possible and economical, because it is the one means which, under favorable conditions, can accomplish its end quickly. Obviously a quick decision is desirable. When we do not attempt it but choose slower means instead, it is because we believe the attempt to be either impossible or likely to succeed only at ruinous cost to ourselves.

TO SPEAK of an operation as ruinously costly brings us to the second part of our subject—the true meaning of the military term "destruction" in such phrases as "the destruction of an armed force." Did Clausewitz sufficiently distinguish between the military "destruction" of such a force (by disorganizing it so that it is no longer an effective instrument of war in the hands of its commander) and the actual physical destruction incidental to that end? In other words, did he count the cost of the superlatively violent sort of war which he advocated? Or did he stress so much the desirability of promptly crushing an opponent as to forget the necessity of not losing too much blood and treasure in the process?

These questions have been thrust upon us both by the events of 1914-1918 and by those of the opening phase of the present war, now nearly ten months old. To what extent was our military philosopher responsible for the excessive cost of the victory of 1918, and what reflections upon the events of the last few months do his writings suggest?

That he distinguished between military "destruction" and actual destruction is clear. Near the beginning of his book, "On War," he wrote: "All depends upon our overthrowing the enemy, that is, disarming him . . . The [enemy's] military power must be destroyed, that is, reduced to such a state as not to be able to carry on the war. This is the sense in which we wish to be understood hereafter whenever we use the expression, 'destruction of the enemy's military power.'" A man disarmed may not be physically injured at all, and as an experienced and intelligent soldier Clausewitz well knew that a hostile force might sometimes be reduced to impotence with little loss of blood. In his own time, all Europe had seen an able general like Mack so outmaneuvered by Napoleon as to surrender himself at Ulm without a general action. In our own day we can go even further: without yielding too much to mere fancy, it is just possible that a considerable force of soldiers might be so incapacitated by some temporary gas that they might all be captured without any of them being permanently a penny the worse.

Further, the military "destruction" of an enemy must result from a decisive success over him, the "destruction" following the decision. And yet much of Clausewitz' "Guide to Tactics, or the Theory of the Combat" turns upon the division of any engagement into a "destructive act" followed by a "decisive act"—the former consisting of the physical and other losses gradually inflicted by the two sides upon each other which result in setting the stage for a "decisive act" by the victorious side, thus reversing the order of destruction and decision.

In this "Guide," Clausewitz uses the term "physical destruction" while reminding his readers that the loss in fighting power of troops which have been heavily engaged is greater than the actual loss in casualties and prisoners inflicted upon them because those who are still free and uninjured begin to suffer from the physical and moral effects of fatigue. Indeed, without forcing the thought, one might liken the gradual losses inflicted by the "destructive act" of combat to the even more gradual losses inflicted by blockade, both being intended to weaken an enemy so as to make possible a decision over him. As to the cost of operations to one's self, our military philosopher was certainly not altogether forgetful of it, for he rightly praises Frederick the Great for realizing that his resources were insufficient to overthrow the great Austrian monarchy and its allies. The operations of the last of the kings, however bold, were never meant to be wholly decisive like those of Napoleon. Frederick was always forced to husband his own strength while inflicting such losses on his opponents that they finally wearied of the struggle against him.

ON THE other hand it is possible to argue that Clausewitz' emphasis was one-sided, that his preoccupation with fighting and his reiteration of the necessity for the most violent and constant exertions made war an end in itself, an emotional melodrama played without reference to its final outcome. As the results of 1914-1918 have reminded the world, a war of efforts and sacrifices so great that the fruits of victory cannot possibly compensate for them is an irrational act.

This criticism, however, falls to the ground if we remember that a man writes primarily for his own time. No matter how much he is convinced of the reality and permanence of truth and no matter how great his interest in its discovery and presentation for its own sake, still he will particularly emphasize such truths as he thinks of most importance to his contemporaries. In proportion to his ability he will, of course, perceive other truths and will mention them and show how they qualify those which he most desires to teach. Thus his work, if sufficiently good, will have lasting value long after the special conditions of his day have disappeared. For instance, the Greek political philosophers are still worth reading in spite of the disappearance of the little "city states" which they had constantly before their eyes. Nevertheless, a writer's main points, upon which he will chiefly dwell, will and should be those which he considers most necessary at the moment.

Clausewitz wrote in the aftermath of the twenty-three years of the Revolutionary-Napoleonic wars. Toward the end of those wars and after their close Europe was sick of blood. The mood of that day has been permanently fixed in Byron's stanzas in "The Devil's Drive" and in the moving prose of De Vigny's "Grandeur et servitude militaires." The pre-Revolutionary dynasties and aristocracies were again in the saddle, and with them there might return the eighteenth-century methods of limited war, the weak side of which our author so thoroughly understood and despised. Given the permanent elements of indecision and timidity, especially moral timidity, in human nature, the weaknesses most to be feared in the generals of the generation after Waterloo were slackness and formalism. Hence Clausewitz' constantly expressed enthusiasm for energy, determination, and fierce fighting regardless of weariness and losses. That both parties to a war might mutually exhaust each other, as in 1914-1918, he did not dream.

One count in the indictment against him is all too true—he wholly failed to understand the sound principle underlying the limited wars of the eighteenth century which he so harshly criticized. In a famous passage he wrote: "Philanthropists may easily imagine that there is a skillful method of disarming and overcoming an enemy without . . . great

bloodshed, and that this is the proper tendency of the art of war . . . This . . . is an error which must be extirpated; for in such dangerous things as war, the errors which proceed from . . . benevolence are the worst." Here his judgment failed him, for he did not see, behind the gushing eighteenth-century sentimentality and behind the unenterprising routines into which limited war sometimes fell, the fundamental truth upon which such warfare was based. In other words he did not understand that force is effective in human affairs only if ridden on the curb; that if unbridled it will destroy the user because he will so anger and frighten everyone as to make a true peace with him impossible. Thus his victories will only increase the number of those who hate him, until at last they will destroy him. This lesson our military philosopher might have learned from Napoleon's fall, following the Corsican's wanton, megalomaniacal invasions first of Spain and then of Russia. Instead he preferred to indulge in romantic hero worship, calling Bonaparte "the god of war." Here his responsibility is heavy indeed.

BEYOND this, the attempt to indict Clausewitz breaks down. A writer who duly qualifies his statements cannot be blamed if men later neglect the qualification and swallow the statement whole. They should know better. Just so our author is by no means responsible for the one-sided cult of the offensive so fanatically preached by those who were in a sense his followers, such as later Prussians like Von der Goltz and Meckel and Frenchmen like Maillard and Foch—the last so much more in practice than in theory. Our old Prussian never tired of calling the defensive the stronger form of war—of course with a limited object. As we have seen with reference to Frederick the Great, he fully understood that a combatant must not exhaust himself.

That strange and scholarly man calling himself "T. E. Lawrence" who ably handled the Arabian side show to Allenby's campaign in Palestine—itself a side show to the great events then occurring in Europe—indeed wrote persuasively against the "exterminative war" which the general staffs of 1914-1918 had learned from the nineteenth-century theorists, making himself in his own words "a clown, leering after them where they with Foch, bandmaster, at their head went drumming down the old road of . . . blood into the house of Clausewitz." Nevertheless the latter in the next world might have shrugged his shoulders and replied in the words of Boswell's Dr. Johnson: "Sir, I can give you an argument but I cannot give you understanding."

More than a hundred years ago, Ludendorff and the other "universal drafters" of all nations—with their irrational idea of a war of unlimited efforts and sacrifices—were refuted in advance in Book VIII, Chapter 3B, of Clausewitz' "On War." In this chapter, bearing the ponderous and right-German title "Of the Magnitude of the Object of the War and the Efforts To Be Made," Clausewitz writes: "As in war the want of sufficient exertion may result not only in failure but in positive harm; therefore the two sides respectively seek to outstrip each other, which produces a reciprocal action. This might lead to the utmost extremity of exertion, if it were possible to define such a point. But then regard for the amount of the political demands would be lost, the means would lose all relation to the end, and in most cases this aim at an extreme effort would be wrecked by the opposing weight of forces within itself."

It would be hard to describe the collapse of Russia and the near-collapse of France in 1917 and the downfall of Germany in the following year more accurately than as "extreme efforts, wrecked by opposing forces within themselves." After all, people are individuals as well as members of nations or other groups, and if you press too many of them beyond a certain point they will either revolt or lie down in despair.

HOW then, both in the light of our experience and of Clausewitz' writing as a whole, can we restate what he says about the military "destruction" of an armed force? First we must distinguish sharply between military "destruction" which is accomplished when the force in question is no longer an effective instrument for war in the hands of its commander, and the actual physical destruction incidental to that end. When the "destruction" of any considerable part of the hostile strength is possible without ruinous actual destruction then it is indeed the best means toward victory for, as we have seen, it alone can bring a rapid decision. Accordingly, we are justified in risking considerable losses to ourselves when the chances of achieving such a decision seem good.

On the other hand, to risk heavy losses deliberately when the chances of success are against us and when other means of continuing the war without disadvantage to ourselves are available is murderous folly. Even a victory may be bought too dearly. If it weaken us too much without being wholly decisive it will leave us exhausted for the remainder of the struggle. Even a total victory, if excessively costly, can be justified only by the cold comfort that the results of defeat might have been still worse. In other words, if we consider a war as a whole, then victory in itself is not its object but victory as a means to a better peace than that which preceded the conflict. Only because a rapid success shortens the war and therefore the eventual losses is it so desirable.

Indeed, if in peace our opponent and ourselves are both parts of a single economic system, which is the case with most modern nations, then we may be injured not only by the losses inflicted upon us but also by those which we inflict upon him. We may impoverish ourselves by permanently ruining a good customer.

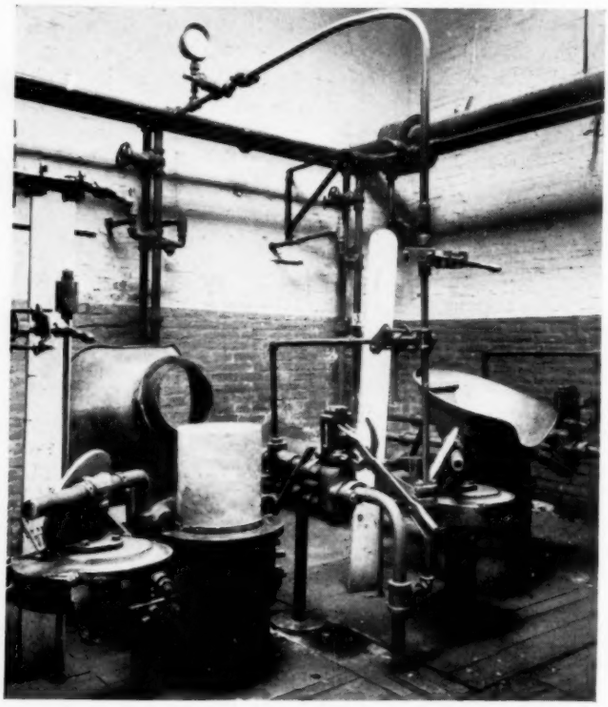
When there seems little chance of "destroying" either the whole or a large part of the hostile forces or when such an attempt seems likely to prove too costly, then we must content ourselves with conserving our own resources as best we may while trying to weaken him by blockade and small war. Such methods are at least better than losing millions of men and shooting off billions of dollars worth of shells in mass attacks without achieving adequate results. Nevertheless a "waiting war" based chiefly upon blockade has its own risks and penalties. When the combined strain of mobilization and blockade is not much greater upon one side than upon the other, the struggle will be long and therefore costly in its own way. Should such a deadlock not be ended either by rebellion or by a negotiated peace of compromise, then sooner or later it will be to the advantage of one side to move. Either some desperate enterprise will seem better than further endurance of inconvenience and privation, or else some prospect of at least a partial decision by arms will be seen. Clausewitz' favorite objective, the "destruction" of the enemy's armed force will then reappear. If there were ever need of proof of this doctrine in modern warfare the Battle of Flanders (May 1940) provided it. There, "destruction" of the enemy's organized forces actually reappeared.

Military Smokeless Powder

Progress in the Search for Improved Propellants

By Dr. C. G. Storm*

DURING the World War, various expedients were employed in attempts to eliminate the muzzle flash of cannon in order to render more difficult the "spotting" of gun locations by the enemy. A more or less effective measure used by the Germans was the addition of potassium chloride or of common salt to the smokeless powder charge. The French obtained some degree of flash reduction by incorporating a small percentage of vaseline or other carbonaceous material in the powder composition. These two methods are analogous to those that have long been used to lower the flame temperatures of coal-mining explosives: the volatilization of the inorganic salts causes a lowering of the temperature and dilution of the combustible gases, while added organic materials lower the temperature by causing the formation of more carbon monoxide and less carbon dioxide.



BLOCKING PRESS, SMOKELESS POWDER FACTORY, E. I. DU PONT DE NEMOURS & CO., CARNEY'S POINT, N. J.

It is estimated that over fifty per cent of the gases produced by the combustion of smokeless powder in a gun are combustible gases (carbon monoxide and hydrogen). Muzzle flash results from the spontaneous explosion of these gases as they mix with the oxygen of the air beyond the muzzle of the gun. Hence, in order to prevent this muzzle flash, the gases must be cooled to such a temperature that ignition will not result during the very brief period that elapses before the gas cloud is diluted and dispersed in the air.

The magnitude of the problem of flash elimination in major-caliber weapons is apparent if a specific case is considered: The 14-inch 50-caliber gun requires, for the 1,560-pound projectile, a powder charge of about 460 pounds. It is calculated that, in the case of pyro powder, the gas is evolved from the charge with a temperature of about 2,240 degrees centigrade (4,064 degrees Fahrenheit) and that if the gas expanded at atmospheric pressure at this temperature it would occupy a volume of 63,457 cubic feet, of which about 35,000 cubic feet would consist of inflammable gases—carbon monoxide and hydrogen. This enormous quantity of combustible gas, owing to its high temperature, ignites as soon as it mixes with the oxygen of the air in front of the muzzle. The flame from the resulting gas explosion is large enough to be seen for miles at night, and objects at a considerable distance from the gun are illuminated by the brilliant glare. Ropes from which velocity screens are suspended one hundred feet from the muzzle have been ignited by the flash.

The Westervelt Board, in its report of May 5, 1919, covering recommendations for future development of guns and ammunition, set up as an ideal requirement that for all weapons "the propelling charge should be smokeless and flashless." The report also contained the following statement: "The board desires to point out the defects in nitrocellulose powder. This powder takes up moisture from a damp atmosphere and deteriorates in its ballistic qualities. It requires elaborate and expensive containers and, even with the containers which have been provided, large quantities of powder have been rendered unfit for service." In other words, the Westervelt Board indicated the necessity for *flashless nonhygroscopic smokeless* powder.

PRIOR to 1919, the work done in this country on flash elimination in cannon involved the mixing of a cooling agent with the service nitrocellulose power (designated pyro powder) or adding the cooling agent to the powder charge in a separate cloth bag or packet. While this method was more or less effective in the case of the smaller weapons, such as the 3-inch or 75-mm. field guns, it produced a decided increase in the amount of smoke evolved, and did not in any manner reduce the hygroscopicity of the powder. The amount of moisture absorbed by pyro powder is a function not only of temperature and humidity of the atmosphere but also of surface area of the powder grains per unit of weight. At a temperature of 90 degrees Fahrenheit and a relative humidity of 90 per cent, powders of the smaller granulations may reach a moisture content of as much as 3 to 3.5 per cent.

An increase of two or three per cent in the original moisture content of powder has a very marked effect on the velocity, thereby affecting the accuracy of fire. Actual firing tests have shown that, in the case of the 75-mm. field gun, each increase of 0.10 per cent in the moisture content of the

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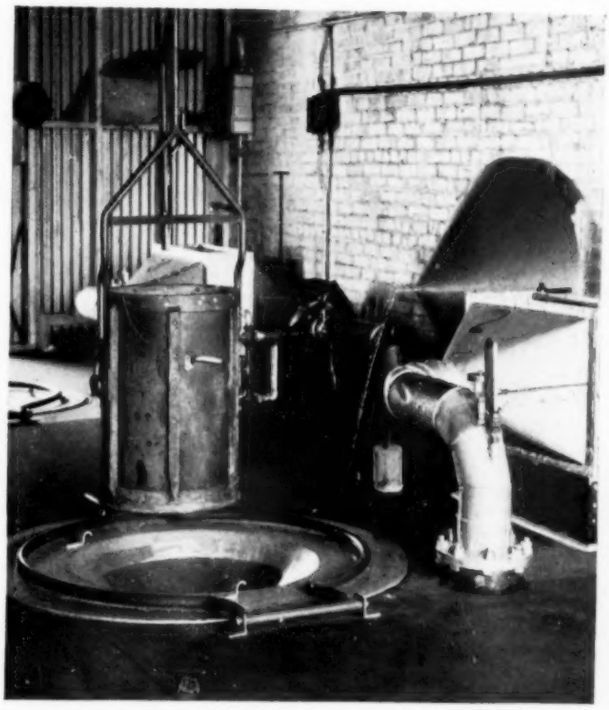
smokeless powder charge results in a decrease of about 6.6 feet per second in velocity and a decrease of about 460 pounds per square inch in pressure. Furthermore, moisture greatly increases the rate of decomposition of smokeless powder, as traces of nitric oxide evolved by deterioration of the nitrocellulose are absorbed by the moisture and converted to nitric acid, which accelerates further decomposition. It is obvious, therefore, that in order to obtain satisfactory ballistic and chemical stability, the moisture content of smokeless powder should be as low as practicable and should not vary with changes in atmospheric conditions.

A PROGRAM of intensive work was initiated by the Ordnance Department in 1919 having as its object the development of an improved type of smokeless powder which would be as nearly flashless and nonhygroscopic as practicable. Private manufacturers of smokeless powder coöperated enthusiastically in this development work. Effort first was concentrated on powder for the 75-mm. gun because it was believed that flashlessness could be obtained more readily in guns of smaller caliber employing smaller weights of powder charge. Hundreds of experimental powder samples, containing various ingredients incorporated in the nitrocellulose colloid for the purpose of reducing its hygroscopicity and eliminating muzzle flash, were manufactured and subjected to proving-ground tests.



CHARGING FLOOR IN THE SMOKELESS POWDER FACTORY AT THE HERCULES POWDER CO., KENVIL, N. J.

Many difficulties were encountered in the course of this work. Certain compositions which gave flashless results evolved too much smoke or were too hygroscopic. The added ingredients affected the ignitibility of the powder grains, so that hangfires were obtained with the 49-grain primer which was then standard. This trouble was eliminated by the development of a new 100-grain primer provided with lateral flame vents and loaded with coarse-grained black powder. The much larger flame spread obtained with this primer facilitated ignition of the charge and not only completely eliminated hangfires but gave more uniform ballistic results.

Finally, in the early part of 1924, a powder was developed which was considered acceptable, and it was approved as a standard type after being subjected to service tests in the 75-mm. gun by the Field Artillery. This powder contained a combination of ingredients serving as flash reducers, waterproofing agents, and nonvolatile colloiding agents for the nitrocellulose. The presence of the nonvolatile solvents made it possible to drive off practically all the volatile solvent used in manufacture of the powder.

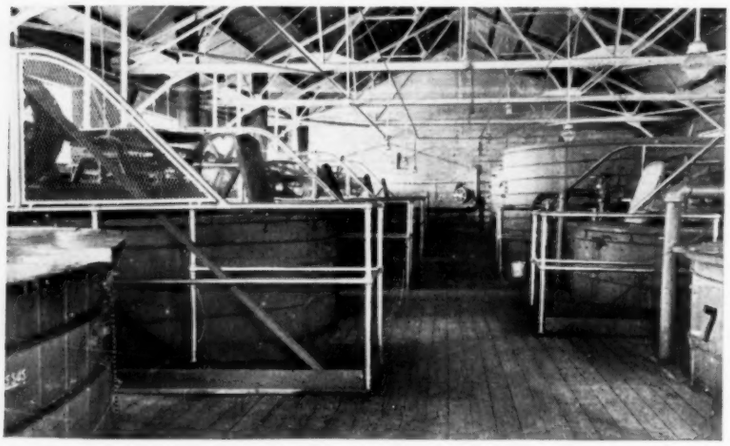
Under extreme adverse conditions of humidity and temperature this powder is only about one-third as hygroscopic as pyro powder of similar granulation. Its low content of residual volatile solvent insures against a change in ballistic properties as a result of volatilization of solvent. As regards chemical stability, it is sufficient to remark that the first lot of this powder made for the 75-mm. gun in 1924 lasted for about 9 years in the "surveillance test" at a constant temperature of 65.5 degrees centigrade (150 degrees Fahrenheit) before showing indications of decomposition—more than four times as long as most pyro powders of similar granulation.

This powder is entirely flashless when fired in the 75-mm. gun. In firings made at night, a small dull-red glow usually is observed for a short distance in front of the muzzle, but this causes no illumination of surrounding objects and is not visible at any great distance from the gun. It fails to register on ordinary photographic films. This absence of flash at night not only prevents "spotting" of the gun position but is of great advantage to the gun crew, as it relieves them from being temporarily blinded at each discharge. The smoke evolved is only slightly greater than that from pyro powder, and it is not objectionable as it is of a bluish-gray tint and is rapidly dispersed.

Another advantage of flashlessness is that when the flash is eliminated the noise of discharge is greatly reduced. This is due to the fact that the report of a gun is made up of two components—the noise caused by the sudden release of the gases from the muzzle and that caused by the explosion of the combustible gases as they mix with the oxygen of the air and ignite. The gas explosion is absent in the case of a flashless powder. This reduction in the loudness of the report interferes with the accuracy of sound ranging.

Various tests have been made which demonstrate the ballistic stability of this type of powder. For example, a portion of a lot made for the 75-mm. gun was set aside immediately after manufacture, and periodic firing tests (5-round groups) were made at frequent intervals during a period of five years—the first test being made the day after manufacture. The average velocity of the last group was within a few foot-seconds of that of the first group, showing that no change in ballistic qualities had resulted from storage during five years at atmospheric temperature. Such powder also has been found to suffer no appreciable change in ballistics during storage for a period of one year at a constant temperature of 50 degrees centigrade (122 degrees Fahrenheit). This type of powder was given the designation FNH (flashless nonhygroscopic) to distinguish it from pyro powder.

SUBSEQUENT to the development of FNH powder for the 75-mm. gun, suitable granulations of the same composition were developed to give the required ballistic performance in other pieces. With certain weapons, where the weight of charge is relatively small in proportion to the diameter of the bore and where the length of barrel is sufficient to provide enough cooling of the gases of combustion as they expand behind the moving projectile, no muzzle flashes were obtained. For weapons with which flashlessness was not obtained, for example the 155-mm. gun, efforts were made to eliminate the flash by increasing the proportion of flash-reducing or cooling ingredient. This was successful when enough was added, but unfortunately this change in composition caused the formation of prohibitive amounts of black smoke. Efforts in this direction were therefore abandoned.



POACHING TUBS FOR PURIFYING PULPED NITROCELLULOSE, SMOKELESS POWDER FACTORY, PICATINNY ARSENAL, N. J.

It was realized, however, that even though it was not flashless in some weapons, the standard FNH composition had the advantage of nonhygroscopicity and hence better chemical and ballistic stability than pyro powder. This type of powder therefore has been adopted for all guns, howitzers, and mortars. For those in which it is flashless, it is termed FNH smokeless powder, and for the others, NH smokeless powder. Suitable granulations have been developed for all weapons for which it became necessary to manufacture new powder to replace World War stocks (ranging in caliber from the 37-mm. gun to the 16-inch gun) and for newly developed weapons. Satisfactory flashless powders have been manufactured for the 37-mm., 75-mm., and 2.95-inch guns, the 75-mm. pack howitzer, the 105-mm. howitzer, and the 155-mm. howitzer.

Much effort has been expended in attempts to eliminate flash in the 3-inch antiaircraft guns without increasing the smoke unduly. Although flashlessness was obtained with only a slight increase in smoke, this increase was pronounced prohibitive, since under unfavorable atmospheric conditions the smoke cloud from a 4-gun antiaircraft battery obscured the target from the sight operator at the director.

Considerable differences in opinion have arisen as to the amount of smoke that can be tolerated in order to obtain the obvious advantages of flashlessness. As regards observation from the air, flash more readily attracts the eye of the observer, whereas a smoke cloud is of such duration that it can be photographed for definite location on a map.

Serious effort also has been made to develop a satisfactory charge for the 155-mm. gun which could be rendered flashless for night firings, when increased smoke would not be objectionable, and which would flash in day firings, when smoke is regarded as more serious than flash. In order to accomplish this result it is necessary that the charge be assembled with a flash-eliminating component which can be removed readily when the smoke produced thereby is objectionable. Schemes that have been tried in numerous experimental firings involved (a) a pad or packet of flash-eliminating compound which could be attached to the charge or inserted between the base section and increment; (b) a bag of small diameter (less than one inch) and of length equal to that of the base section, filled with the flash eliminant and inserted as a longitudinal core, which could be withdrawn when not required; (c) a jacket made of cartridge cloth heavily impregnated with the flash eliminant and tied over the outside of the charge so that it could be removed as desired. Of these methods, (a) was the only one that gave consistent flashlessness, but unfortunately it also produced poor uniformity in ballistics. The other methods were rejected largely on account of mechanical difficulties. Efforts toward solving the problem of flashlessness in the 3-inch antiaircraft guns and the 155-mm. gun are being continued.

SINCE the standardization of FNH and NH smokeless powder, much attention has been given to the question of methods of improving ballistic uniformity in various weapons—in other words, minimizing velocity variations. Particular success in this direction has been obtained in the 155-mm. gun. It was realized that for use in guns where flashlessness could not be obtained without the production of excessive smoke, the basic composition of the FNH powder could be modified by reducing the amount of the flash-eliminating ingredient without affecting the nonhygroscopic qualities of the powder and that such a change in the composition would increase the potential energy of the powder; *i.e.*, provide a "quicker" powder. This would permit the use of a smaller weight of powder to obtain service velocity. A decrease in weight of charge would reduce the volume of the charge, thereby facilitating uniform ignition with resultant decrease in velocity dispersion.

The 155-mm. gun appeared to be an excellent one in which to determine the advantages of such a change in view of the fact that the service charge of either pyro or NH powder practically filled its chamber to capacity. Irregular velocities and erratic pressures in this gun have been demonstrated to be caused by improperly made charges, which, because of too great diameter, baffle the ignition flame from the black powder pad at the rear end of the charge, delaying ignition of the powder in the front end of the charge. Theoretically, the entire surface of every powder grain in the charge should be ignited at the same instant in order to obtain maximum ballistic uniformity. If the rear portion of the charge is burning vigorously before the front portion has become ignited, it is obvious that there will be a very appreciable gas pressure in the chamber by the time the front portion of the charge starts to burn. This part of the

charge will therefore, under the influence of this pressure, burn at a much higher rate than it would had the entire charge been ignited at the same time. The result will be excessive pressure and velocity.

The results obtained in the 155-mm. gun by a small change in the proportions of ingredients of the original FNH composition, such as referred to above, have been most gratifying. In the ballistic acceptance tests (7-round groups) of a considerable number of lots of powder, the modified composition has given an average maximum variation in velocity of only eleven foot-seconds as compared with an average of about twenty foot-seconds for the original composition. Another distinct advantage has been gained as regards weight of charge, the average weight of service charge having been decreased from about 26.4 pounds to 24.7 pounds—a decrease of 6.4 per cent—which represents a considerable saving in cost of powder per round. Time-pressure measurements have shown that the burning rate of the modified composition is nearly 18 per cent higher than that of the original composition.

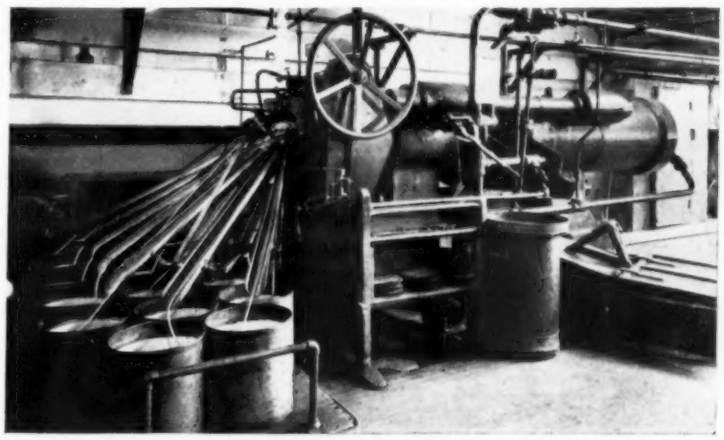
Great improvement in velocity uniformity in the inner zones of the 155-mm. howitzer has been effected by the adoption of two separate types of charge for this weapon: one, the M1 charge, is for use only in the first five zones, the other, the M2 charge, is for use in the fifth, sixth, and seventh zones. The M1 charge is made of a smaller granulation of powder than that used in the M2 charge, so that the pressure obtained with the M1 charge in the fifth zone is approximately as high as that of the seventh-zone M2 charge. The fifth-zone M2 charge is contained in a single bag, while that of the M1 charge is in five separate bags.

In the major-caliber guns, the powder charges are much larger in proportion to caliber than they are in minor- and medium-caliber weapons. For example, in the 12-, 14-, and 16-inch guns, the maximum weights of charge may be approximately 300, 500, and 800 pounds, respectively. There have been frequent occurrences of erratic high pressures in such guns, which may be due, among other possible causes, to non-uniform ignition of the powder charge, the effect of which already has been discussed.

THE development of improved propellants for guns using fixed ammunition has been made possible only by the development of improved primers. In fixed ammunition, the primer alone is responsible for the ignition of the propellent charge. Our World War ammunition for the 75-mm. gun employed the same granulation of powder for both high-explosive shell and shrapnel in spite of the wide difference in the weight of the two projectiles (11.72 pounds and 15.96 pounds). Since the maximum allowable pressure in the gun was the same for both projectiles, a powder of proper granulation to give close to the maximum allowable pressure of 36,000 pounds with the heavy projectile gave only about 23,000 pounds with the lighter one. This was pyro powder of approximately 0.025-inch web thickness.

In developing FNH powder for this gun, it was thought preferable to use different granulations for the two projectiles so as to obtain pressures near the maximum in each case, thereby improving the ballistic uniformity and also eliminating the occasional muzzle flashes which occurred when the lighter projectile was used. The original FNH powder was in the form of cylindrical grains with seven perforations and a web thickness of about 0.023-inch. The charge for service velocity was about 24 ounces with the lighter projectile, and the pressure was about 23,000 pounds.

To simplify the manufacture of a quicker powder, resort was had to a single-perforated grain having a web thickness of about 0.018-inch. Although this powder gave service velocity with a pressure of about 31,000 pounds per square inch and a weight of charge of only about 20 ounces, occasional erratic pressures—sometimes as high as 50,000 to 60,000 pounds—accompanied by relatively small increases in velocity, were encountered.



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After many months of experimentation, it was found that the erratic pressures were actually wave pressures, caused by non-uniform ignition of the charge. The small, single-perforated grains (about 30,000 to the pound) packed much more tightly around the primer vents than did the larger multiperforated grains (5,000 to the pound). Hence the gases of combustion from the one hundred grains of black powder in the primer built up a higher pressure immediately around the primer, causing intense local ignition rather than uniform ignition of the entire charge. Complete elimination of erratic pressures and marked improvement in velocity uniformity was obtained by the adoption of a side-vented primer about seven inches long, extending beyond the center of the charge. The net result of this development was a reduction in weight of charge from about 24 to 20 ounces (a saving of about 16 per cent in powder) and improved uniformity in ballistics.

Subsequent development work proved the practicability of manufacturing multiperforated FNH powders having a web thickness as small as 0.016-inch or even less which averaged about 5,600 grains to the pound, and considerable amounts of such powder have been manufactured. Owing to the fact that, in spite of their smaller web thickness, the multiperforated grains are much larger and hence pack less densely than the single-perforated grains, the former gave no erratic ballistic results with either type of primer.

It is apparent from the foregoing that the development of improved methods of ignition and assembly of propelling charges must go hand in hand with the development of improved propellants in order to obtain optimum results.

Defense Against Night Bombing

The Problem of Stopping the High Speed Airplane

By Maj. Thomas R. Phillips*

NIGHT bombing was the rule during the last year of the World War. Bombing at first was done almost entirely during daylight, but increasing effectiveness of antiaircraft protection and fighter aviation made daylight bombing in the hostile interior too dangerous to be risked. The air bombardments of the present war have followed the same course.

German attacks on English naval bases and shipping initially were made in daylight, but in March 1940, German attacks on shipping were made at dusk or during darkness, and the attack on the Scapa Flow base, March 17, 1940, took place in darkness. The British retaliated with a night raid on the Island of Sylt. While bombing at night is much less accurate than during daylight, the greatly lessened risk probably will induce all contenders to conduct most of their bombing at night.

Defense at night against bombardment is much more difficult than in daylight. Airplanes must be illuminated to be fired upon. Interceptor aviation is faced with an almost insuperable task of finding the enemy during darkness unless it, too, is aided by searchlights. The problems of air defense are not even half solved if the defensive problem at night remains unsolved.

There are two schools of thought concerning defense against night bombardment, each with its passionate protagonists. These two schools may be represented by the defense of London in 1917-1918 and that of Paris in the latter half of 1918. The English scheme was devised by General Ashmore and is described in his book, "Air Defense," which, unfortunately, is the only study of the subject in English. General Ashmore used fighters, searchlights, and antiaircraft artillery in sharply delimited zones for fighter and antiaircraft action. Fighter zones were provided with searchlights to illuminate the raiders. (The French system used no aviation.) General Ashmore's advocacy has had considerable influence in England and the United States in creating support for this plan.

In the layout of the London defenses in 1918 the fighter patrol zones were only from four to ten miles wide. If a bomber flying eighty miles an hour crossed them perpendicularly, its time in the fighter zone would have been from 3 to 7½ minutes. This is an exceedingly short time for a fighter to find and engage a bomber, even when illuminated. Attacks in 1918 were much more leisurely than now, and the bombers would maneuver in the fighter patrol zone looking for a hole in the antiaircraft barrage fire. The fighter threat apparently was so slight that bombing raids usually took place over a period of several hours, so that the serious problem defensive fighters now face, that of getting into the air in time to meet the raiders, was not so difficult then.

In reality, night pursuit failed in England. There were twenty-two night airplane raids on Great Britain between the nights of September 2-3, 1917, and May 19-20, 1918, when the last raid was made. During this period, according to the British Official History, "War in the Air," Volume V, the defensive night pursuit, which varied in strength between 120 and 200 aircraft, brought down 5 enemy raiders. However, ten British defending airplanes were destroyed in crashes and accidents in the air or landing, a ratio in favor of accidents of two to one. During the same period antiaircraft artillery shot down eleven German raiders.

MOREOVER, antiaircraft fire had a much greater deterrent effect than fighter action. This was in spite of the fact that antiaircraft guns at that time made little attempt to fire at the raiding airplanes. The position of the hostile craft was usually judged from sound, and the practice was to put a barrage in front of them. In his narratives of the twenty-two raids, General Ashmore notes that the antiaircraft barrage fire forced German bombers to turn off during eleven of them. A typical narrative, that of the raid of January 29, 1918, reads as follows: "Two of the Giants (4-engined bombers) came as far as London. One of these skirted all around the inner defenses (in the illuminated zone of fighter action) and made several attempts to turn in toward the center. These were all frustrated by the barrage fire."

The raid of May 19-20, 1918, was the final German airplane raid on London. According to German records, forty-three ships started, and at least nineteen of them reached London (the British record thirteen as reaching London). Three were shot down by fighters and three by antiaircraft fire according to the British Official History. Concerning this raid, General Ashmore states: "The success of our night fighter pilots in England May 19th finally convinced our GHQ in France of the value of this form of defense." At best this was a very limited success, and May 19th was the only night that anything that could be called success at all was attained. In the other twenty-one raids, only two enemy airplanes had been shot down by the pursuit while ten of the defending fighters had been lost due to crashes.

To destroy 5 (Official History; General Ashmore claims 7) German raiders in 9 months, the British kept from 120 to 200 first-class fighter airplanes and pilots inactive. Concerning this, General Ashmore states: "Toward the end of the war, 200 first-class fighter machines and 200 highly trained pilots (they would have been of great value in France) were kept, as Ludendorff claims, 'far from the front.' Air defense from the ground was less harmful in this respect. A large proportion of the 20,000 men employed on antiaircraft guns, searchlights, aprons, etc., in England were considered medically unfit for service overseas." It is strange to find such a tremendous effort which brought forth such meager results called a success. On the contrary, it more properly could have been considered a striking failure. The defensive fighters had little moral effect in driving off the raiders, whereas the unaimed gunfire proved to be quite successful in this respect.

Captain Nicholson, in a very interesting article in the

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Coast Artillery Journal of September-October 1939, quotes General Ashmore approvingly with respect to the results attained by No. 151 Night Fighter Squadron which was sent to France "in view of the increase in enemy bombing activity [in France] in May 1918" (Official History) and not because, as General Ashmore states, of the success of night fighters in England. The squadron was sent to France in June 1918. Up to the time of the British offensive on August 8, 1918, its main task was night defense of the Abbeville area. An elaborate defense system which employed many searchlights and antiaircraft guns was evolved, and the squadron was placed in wireless communication with the antiaircraft defense commanders from whom an early warning of the passage of night raiders was obtainable.

Eventually a scheme was completed whereby a wide belt, or barrier, of searchlights and guns was established in two lines nearer the front, from the north of Arras to the Foucaucourt-Amiens road. This searchlight-and-gun barrage, about forty miles long and of unstated depth, with which the activities of the fighters were coördinated, proved effective. According to the British Official History, No. 151 Night Fighter Squadron, during five months' service in France, shot down sixteen German bombers on the British side of the lines, and ten on the German side, for which there was confirmation of four. During the four months from July to October, inclusive, the British antiaircraft guns, according to the same source, destroyed forty-seven German airplanes and damaged forty. These comparative statistics are of interest because of their relation to the length of the front. The British front was only ninety miles in extent August 8th and sixty miles in extent November 11th. The fighters, on an average, were covering half the front, but shot down only a quarter as many bombers as the antiaircraft guns.

PARIS was defended in the early months of 1918 by a combination of night fighters and antiaircraft guns and searchlights. General Mordacq, Prime Minister Clemenceau's Chef de Cabinet, stated in May 1918: "Paris was not far from being partially destroyed by the Gothas; that is a fact, misunderstood in reality, but which history will register when it is written impartially. The greater part of the men who were closely involved in Government councils in 1917 and 1918 already were absolutely convinced of it." The Under Secretariat of Aviation believed that the best method to insure the defense was to increase the amount of aviation for the defense. General Mordacq considered that this would lead to still worse results and succeeded in winning the Prime Minister's support for his views. (See "In Defense of Antiaircraft," ARMY ORDNANCE, March-April 1939, Vol. XIX, No. 113, p. 282.)

On May 20, 1918, orders were issued that all aircraft held for the defense of Paris would be released and sent to the front. They were sent to the aviation field near Meaux with the mission: (1) To reconnoiter continually, and especially in the evening, between the front and Paris in order to signal, if possible, the arrival of German bombardment squadrons; (2) To attack these squadrons when, *after having bombed Paris,* they were returning to their landing fields.

Comparison of the results of German raids on the French capital during the first and last months of 1918 reveals a marked difference. During the first 4 months of 1918, 6 raids were undertaken against Paris, with a total of 172 airplanes. Twenty-two airplanes (13 per cent) reached their targets and the weight of bombs dropped was about 7 tons. During the last 6 months, 22 raids were attempted, the number of airplanes totaling 315. Of these, only 15 (5 per cent) reached Paris, and the total weight of bombs released over the city was 4½ tons. The effectiveness of the antiaircraft defense was almost tripled when aviation was no longer depended upon and no longer interfered with the gunfire. Of the fifty airplanes which took part in the night raid of September 16, 1918, only three reached their objective, and of these three, two were ultimately brought down by gunfire. This insignificant result still was an improvement by the enemy compared with the utter failure of the five preceding raids in the course of which not a single airplane reached Paris.

In view of General Mordacq's statement of why airplanes were not used in the defense of Paris, it is interesting to note General Ashmore's version. He states: "There never was available for the defense of Paris a strong force of efficient fighter machines, such as we possessed in the London air defenses. Paris suffered for want of a William Weir. The dependence on antiaircraft guns was explained. It was forced on the authorities by the absence of suitable aircraft." This remarkable statement, which General Ashmore must have known was questionable, indicated his bias in favor of a method which he devised and championed. The Paris defenses were more successful than those of London in preventing bombing, in spite of the use by General Ashmore of a fighter force of twenty squadrons.

UP until the time they were relieved from duty in Paris, the French defending aircraft never shot down a German raider. On the other hand, they lost a number of their own ships in taking off and landing. Capt. Pierre Weiss, a pursuit squadron commander, writing in *Revue militaire generale* in November 1920, states: "Night pursuit never has given results comparable with its expenditures. The aviation forces of Le Bourget, charged during the war with the security of the Capital, did not prevent, or even trouble, any raid of the Gothas or dirigibles. I have never heard of authentic aërial combats at night above Paris. The Antiaircraft Defense Corps can thus inscribe in its book of honor all the victories reported by the boasters."

Captain Weiss discusses whether or not the aviators were responsible for the failure of night fighter machines and comes to the conclusion that it was inevitable. "One demands then: since this organization of night aërial defense was impotent, why was it created and conserved? Necessities of political and moral order—that of giving an immense city faith in its security. It is possible that this necessity was primordial. . . The other side of this feeling of security, alas, was the deception which followed the illusion. The aviators of the entrenched camp of Paris learned it to their sorrow when they promenaded on the boulevard the day after a deadly raid. The protection of cities, day or night, is a vain word when it is confided to special units softened by this passive duty. No more than a company of infantry, without a baptism of fire, can defend an important fort by closing themselves in its walls, is an assembly of pilots, whose nerves are not put daily to proof in the passage of lines and the atmosphere of enemy sky, equal, by a play of stagnant patrols, to interdict a corner of space to the adversary."

Germany did not depend on night pursuit. "It was, to tell the truth," states General von Hoeppner, commander of the

German air and antiaircraft forces during the war, "rarely effective; for in the immensity of the sky it was difficult to judge distances, and in trying to get too close to the adversary they were exposed to collision. The most critical time for our bombers was on landing, for the fields then were lighted and constituted good points for the hostile fighter pilots to watch."

During the World War, Germany developed its antiaircraft defenses more extensively than any other nation. At the Armistice they had 2,548 antiaircraft guns, and in 1917 adopted the 88-mm. caliber as standard. It so happens that the only book in English dealing with the problem of defense against night bombardment is by a protagonist of a method that failed everywhere it was tried, except for the minor success of No. 151 Night Fighter Squadron in 1918 at the front. Even this relative success should be evaluated critically before it can be accepted as applicable to different conditions. Sixteen airplanes shot down in four months over their own lines is a very small number. No information is available of the number of raiders that passed over the lines, but it probably was in the thousands. As a proof of the effectiveness of night fighters in stopping enemy raiding, such results are negligible. The same effort used to raid German airdromes should have accomplished much greater results, if we can judge by the success of German raids on British airdromes.

Air defense at the front also represents a special condition. Bombing is usually from low altitudes and gives the defensive fighters time to take off and engage the enemy. Bombing in 1917 and 1918 often was performed by a succession of flights or single planes, so that if the first few raiders were missed those who followed might be picked up. Airplanes frequently circled and returned to the same target, not being forced to the high-speed hit-and-run tactics that can be expected today. General Ashmore mentions one raid which was exceptional for its rapidity—the raiders traveled eighty miles an hour and were over England only an hour and a half! Raids over London sometimes lasted four or five hours, with the raiders circling and coming back and seeking a hole in the antiaircraft barrage.

TODAY, the value of night fighters against night bombardment cannot be determined solely by the experience of twenty-two years ago. Our problem is to determine if modern speeds have increased the possibilities or have decreased them. The factors that will influence the value of night interceptors are the time and space elements in meeting raiders, the width of the searchlight band demanded for high-speed interceptors, the altitude at which attacks are made, and the possibility of defense of certain objectives by this means.

The most important change caused by high speed is to increase the warning distance required, day or night. This subject is far from being understood and its importance assessed. Different figures are given by different persons. The figures will vary with the assumptions used. In the following table three different conditions are assumed along with three different ratios of interceptor and bombardment speed. The first condition includes a 15-minute alert period, an altitude of about 18,000 feet, which requires 8 minutes' time for the defender to gain this altitude and reach a point 25 miles in advance of the airdrome, and an allowance of 10 miles for missing the raiders, resulting in a 10-mile chase. The second computation reduces the alert time to 5 minutes and the third eliminates the allowance for a 10-mile chase.

WARNING DISTANCE REQUIRED FOR INTERCEPTOR PURSUIT

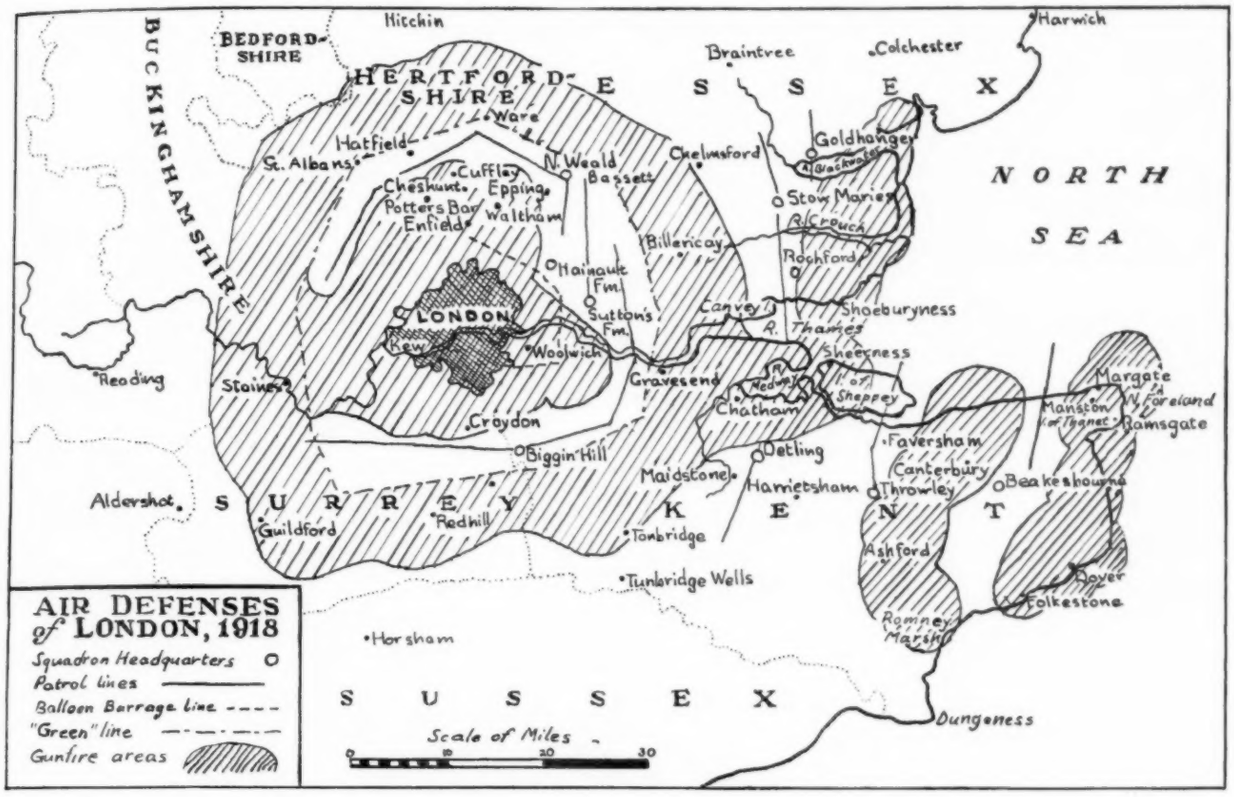
	I *15-min. alert* *10-mile chase*	II *5-min. alert* *10-mile chase*	III *5-min. alert* *No chase*
360-m.p.h. interceptor vs. 300-m.p.h. bomber	230 miles	180 miles	90 miles
300-m.p.h. interceptor vs. 240-m.p.h. bomber	189 "	149 "	77 "
360-m.p.h. interceptor vs. 240-m.p.h. bomber	149 "	109 "	77 "

No one knows what the average practical alert period can be. The U. S. Army Air Corps assumes that a 15-minute alert is required when the personnel are at their ships and the engines periodically warmed up for take-off. This period must also include, for the purpose of these computations, the time delay in receiving warning of the approach of raiders. Where fighters are on the ground waiting for warning twenty-four hours a day, even with two or three crews, it may be doubted that the best of crews will be able, on the average, to assemble their squadrons from camouflaged localities all around the field and take off in less than fifteen minutes. It is important that this time be reduced to lessen the warning service's difficulties. It appears to be primarily a matter of organization and of a method of keeping engines warm so that the fighters can take off without delay. Reduction of the alert period from fifteen to five minutes reduces the extent of the warning net between forty and fifty miles. Reduction in altitude of the attack also will decrease the warning time slightly.

THE problem of the intercepting fighters meeting the incoming raiders directly is habitually overlooked. That these two groups, approaching each other at a combined speed of five or six hundred miles an hour, should run straight toward each other, is improbable. It is much more likely that they will miss by distances up to forty or fifty miles. With radio communication, the interceptors can be directed to a certain extent. To assume that interception will be made without any chase, as a rule, is simply to overlook one of the inherent and ever-present difficulties of interception. Computations are made in the table eliminating this allowance, but it is not believed that any warning net which fails to extend out far enough to allow for this factor can be considered effective.

Under ideal circumstances of organization and interception the minimum warning distance to meet a raider twenty-five miles in front of the defended objective, is seventy-seven miles. The ordinary practicable warning net for 24-hour interception of high-flying bombardment airplanes should be about two hundred miles out. Reduced alert time will decrease this to about one hundred and fifty miles. Any lesser extent of warning net will fail to give interceptors a reasonable expectancy of meeting the raiders, except by luck.

This provides us with one of the limitations of night interception for antiaircraft defense. It cannot operate without an extensive warning net. During the World War, speeds



were about one-third of what they are now. Today, German raiders can reach London after a 7-minute flight over English soil. In the World War, their minimum time over England was an hour and a half going and coming. The English warning net was effective twenty-one years ago. Today it is ineffective, except against low-flying airplanes, unless it comes from ships at sea or from neutral coasts. The success of the interceptor defense of both England and Germany in the present war indicates that both have "unarmed fishing vessels" out in large numbers, equipped with radio to provide warning. It should be noted, however, that most British interceptions have been made when German airplanes were returning *homeward*. Both German and British attacks on "unarmed fishing vessels" have been numerous in their efforts to wreck the opposing warning service.

Airplane speed has another effect on this problem. General Ashmore laid out fighter patrol zones from four to ten miles in width between his bands of antiaircraft fire. His aircraft had difficulty in keeping out of antiaircraft fire in these narrow zones, as might be expected. The equivalent width of a zone today would be from sixteen to forty miles. This is an equal time of flight zone for raiders to cross. However, the size of the fighter zone affects the searchlight problem materially. The inner band of the London antiaircraft defenses had a diameter of between twenty-five and thirty miles in 1918. Suppose this antiaircraft zone is surrounded by a 30-mile-wide interceptor band. The air-patrol zones then cover more than 5,600 square miles. With one searchlight per four square miles, a requirement of 1,400 searchlights is set up.

In view of the extreme difficulty of warning and interception, it may be doubted that any such expenditure of material and personnel would bring compensating results. This really poses a problem similar to one which General Ashmore disposed of. He writes: "Various suggestions were made for helping in night defense. One that came to me through the Air Board was to organize a system of flood-lighting over a large part of the south of England—our pilots, flying high, would see the raiders silhouetted against the illumination. It would have been cheaper to move London." It would be cheaper to move London now than to supply it with the equivalent of the lighted interceptor zones employed in 1918. The same conclusion must be drawn in regard to the defense of any area. The interceptor zones have to be large enough for a 3- to 5-minute flight across, if they ever are to offer a chance at interception. The searchlight requirements are such that no compensating results would be obtained.

The delimitation of fighter and antiaircraft zones never has been solved satisfactorily. Either the antiaircraft must hold its fire, not knowing friend from foe, or else the fighter must break off just at the moment he may be in a position to down the enemy. In most localities it would be impossible for the pilot to know the exact moment he left his patrol zone and entered an antiaircraft-artillery zone. Air maneuvers in the Soviet Union have confirmed the justice of this objection.

Experimentation certainly should be conducted to make use of night interception. In general, important localities will have interceptor pursuit for their defense in daylight, and the use of the same interceptors at night requires only additional crews and searchlights to illuminate the area. Whether or not they are effective is susceptible of determination in peace, although even a test will require the use of more searchlights than exist in the United States, and a warning net will be required larger than any heretofore set up.

These are problems that desperately require solution. No possible means of air defense should be overlooked. If night interception is a practicable means of defense, this can and should be discovered by experimentation that should be taking place at the present time. Antiaircraft guns alone cannot guarantee complete protection against raiders unless they are emplaced in many successive rings. The practicability of night interception should and can be solved realistically by peace-time tests.

THERE is a general misunderstanding of the relative cost of antiaircraft-artillery defense and fighter defense. Of 1,607 French airplanes destroyed during the year 1918, 705 were victims of German aviation, 362 of antiaircraft artillery, and 540 of undetermined causes. The percentage of losses due to antiaircraft artillery in respect to total losses is thus between 362/1,607 and 902/1,607, or between 23 and 56 per cent. German statistics (Neumann: "Les forces aériennes allemandes dans la guerre mondiale") indicate that Allied antiaircraft fire killed or wounded 837 German aviators, while air combat resulted in 3,096 losses. If matériel and personnel losses were approximately proportional, antiaircraft artillery can claim 21 per cent of the total Allied successes. ("Que peut-on attendre d'une D. C. A. moderne," by Commandant Courbis, *Revue militaire generale,* August 1938.) Although antiaircraft artillery was far from representing the majority of the Allied successes, it should be noted that these were gained almost without losses of men and matériel. This was not the case with pursuit aviation; in 1918, the French lost 658 fighter machines and about 900 pilots, of whom half were killed.

What were the relative importance of the means of these two arms? In 1918 the French antiaircraft artillery had cannon varying in numbers between 415 and 544. They were not only used during this period without replacement, but the larger part of them are again in service in France. Aviation, on the contrary, had between 750 and 1,400 fighter airplanes on the line and an approximately equal number immobilized in depots or schools in the interior. Futhermore, regular replacement of worn-out and destroyed airplanes amounted to about 50 per cent a month, leading to a number constantly in service of about 5,000.

If it is contended that fighter aviation had fewer effectives than the antiaircraft artillery, this statement is true only if actual batteries and squadrons are counted. It is not true if to front-line airplanes are added the airplanes in depots, parks, and schools. It is still less true if it is recalled that factories used 186,000 men, more than one-quarter of whom were working on pursuit ships.

Then as to relative effectiveness per unit, statistics for the 15th Chasse Group given by Commandant Courbis, in the article previously cited, are illuminating. In April and May 1917, this group (90 fighter airplanes) claimed to have engaged in 694 combats. It lost 21 pilots, had 21 successes confirmed of German losses, and claimed 31 more unconfirmed. This corresponds to a maximum of 73 decisive combats. Thus 621 combats, about 90 per cent of the total, were without result. It is not by any means certain that 90 per cent of the antiaircraft fire was without result.

One German airplane was destroyed in the London balloon apron during the Great War and two British airplanes were caught in the German aprons. One German Giant went through a British apron without disaster, continued on its course, and returned to its field. During the War the British aprons consisted of cables swung between balloons with wires hung from the cables. The weight of this arrangement limited to 8,000 feet the altitude to which it could be raised. The balloon apron forced German bombing above this altitude and, since the ceiling of their bombers at that time was only 11,000 feet, caused considerable trouble.

Concerning German aprons in the war, General von Hoeppner states: "To escape the increasingly powerful action of our night antiaircraft artillery, the enemy had, since the middle of 1916, attempted to surprise us by descending in a glide with motor stopped and only dropping the bombs when arriving at a low altitude. As a measure of defense, we experimented with barrages by balloons or kites, and we finally decided to install barrages of small balloons in the most menaced regions. Barrages of this nature existed in the industrial regions of Luxemburg and Lorraine, in the Sarre, and near Leverkusen. Their efficaciousness during darkness was real, especially against airplanes flying low. The statistics of bombardments did not delay in showing us the care with which the enemy avoided the regions defended by this means. The action of barrages was then combined with that of artillery, and a zone was created that was almost uncrossable, by intercepting the upper air with cannon and the lower with balloons."

THE present French-Italian type of barrage using tandem balloons, one above the other, rises to 33,000 feet. Present balloon barrages use a single cable and the balloons are placed in staggered rows. The cables are heavy enough to wreck modern airplanes. Germany, according to the French General Serrigny will protect all exposed regions by this method. For France, General Serrigny recommends a Maginot Line of the air to consist of 3,000 balloons along the entire German border.

The *Volkischer Beobachter* carried a full page concerning the German system of barrages in June 1939. The barrage batteries had all been put in place to protect the industrial centers and large cities of Germany during the September 1938 crisis. The German barrage can reach 33,000 feet, but this altitude rarely will be necessary, since the cloud ceiling in Germany averages about 10,000 feet during 10 months of the year.

Balloon barrages are good only at night, since the balloons can be shot down in daylight without difficulty. Consequently they must be doubled with antiaircraft artillery. This makes a good combination, since the artillery is most effective in daylight and the balloons are very serious deterrents to air action at night.

The whole problem of antiaircraft defense constantly is becoming more acute. The day already has arrived when the United States can be raided across the Atlantic ocean. Every means of antiaircraft defense must be combined in order to assure protection. Raids can be expected habitually to be made at night, when protection is most difficult. Until the problem of warning and protection at night is solved, the entire problem of antiaircraft defense remains unsolved. Whether or not night interception is practicable can be determined by experiment in peace. Assuredly no means should be overlooked, nor, on the other hand, should any faith be placed in various proposals for defense until they have been tested to the fullest extent possible in peace.

Modern Trench Mortars

Infantry Weapons with High Trajectory for Close Support

By Capt. Daniel J. Martin*

STABILIZATION of warfare on the Western Front early in 1915 created a demand for a mobile high-angle short-range weapon. The necessity for a weapon of these characteristics had not been foreseen by any of the warring nations, but immediate action was taken by all powers to provide a mortar of the desired type. Simplicity, ease and rapidity of manufacture, and the maximum in mobility were demanded of the designers. In general, the results obtained by the several nations were very similar. The Stokes 3-inch trench mortar is the one best known in this country because, based upon General Pershing's recommendation from overseas, it was adopted as standard for use in the United States Army a few months after we entered the war. The characteristics of the Stokes mortar are given in the table on the last page of this article for comparison with those of our present standard 60-mm. and 81-mm. mortars.

INFANTRYMEN FIRING THE BRANDT 60-MM. MORTAR

The principal mission of the mortar is the close support of the rifle companies of the infantry. Hence the weapon is an integral part of the infantry regiment. Its mission is best accomplished by concentration of fire on machine-gun nests and on areas which, because of irregularities of the terrain, cannot be reached by flat-trajectory weapons. To move with the infantry it must be light in weight, and its principal components must be so designed that they can be manhandled from one position to another with rapidity, even while under enemy fire. To accomplish its mission, it must be rugged and durable, and at the same time accurate enough to be reasonably effective.

The 3-inch Stokes mortar was admirably suited to fulfill these requirements. More than 1,300 were issued, and a large number are still in service. The two major faults of the weapon are inaccuracy and lack of range. Any smoothbore mortar firing a projectile without fins will exhibit these deficiencies. The projectile will tumble in flight, its resistance to passage through the air will be materially increased, and decreased range will result. Since the probability that any two projectiles will tumble in exactly the same way is almost nil, naturally the dispersion always will be excessive.

Postwar development of this matériel was based on the findings of the Caliber Board. This board, often referred to as the "Westervelt Board," under the presidency of Brig. Gen. William I. Westervelt, was appointed in December 1918 "to make a study of the armament, calibers and types of matériel, kinds and proportion of ammunition, and methods of transport of the artillery to be assigned to a field army." Its personnel included members of the Ordnance Department and of the using arms. The board made a comprehensive survey of the experiences of the Allied armies, and almost all our present equipment can be traced to its recommendations. It recommended that an infantry-accompanying gun of about 75-mm. caliber be designed to replace the 3-inch Stokes mortar. The faults inherent in the Stokes mortar were to be overcome by use of a rifled weapon or by the addition of fins to a projectile to be fired from a smoothbore. It also was felt at the time that the new design should permit use of the weapon at low angles of elevation for service against tanks.

During the period immediately after the World War, efforts were concentrated on the design of a breech-loading rifled weapon to be known as the infantry howitzer. Pilots of several promising designs, all about 75 mm. in caliber, were built and subjected to exhaustive tests. The most important result of these experiments was the decision that one weapon could not serve the requirements of the infantry and

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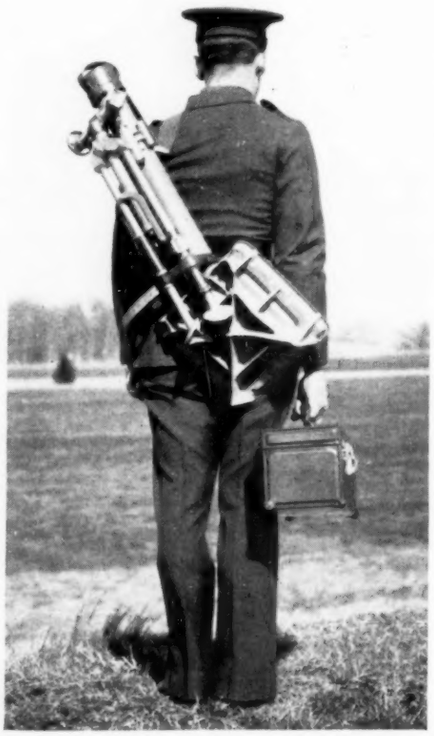
that it would be necessary to have two weapons—one the mortar and one the antitank gun. (Further development of the antitank gun was discussed in an article, "The Antitank Gun," by Col. G. M. Barnes, in the July-August 1939 issue of ARMY ORDNANCE, Vol. XX, No. 115, p. 25.)

The decision then was made to develop a breech-loading rifled infantry mortar, and two sizes were built for proving-ground test. One of these, a 2.24-inch weapon, was declared unsuitable for its purpose because of its small power-to-weight ratio. The other, a 75-mm. mortar, gave rather promising results, and efforts were made to perfect it. In spite of the very limited amount of money available during the next few years and the higher priority set upon the development of more urgently needed equipment, a certain amount of progress was made in trench-mortar development. Breech-loading smoothbore mortars were tested, and improvements were made in the breech-loading rifled 75-mm. mortar. By means of these changes, the range of the mortar was more than doubled. Accuracy, however, was not improved to the extent desired.

Four 81-mm. Brandt mortars were purchased for test in 1931. A complete description of this mortar was given by Capt. E. C. Goebert in the March-April 1933 issue of ARMY ORDNANCE (Vol. XIII, No. 77, p. 281). The Brandt-type projectile was developed shortly after the World War for use in the Stokes mortar, and the Stokes-Brandt postwar mortar is in reality a combination of Stokes' principles for the mortar, with Brandt's projectile. The principles of construction and operation are very similar to those of the Stokes mortar. The range and the accuracy, however, were materially improved by the use of a teardrop type of projectile with suitable fins to keep it from tumbling in flight. Advantages of simplicity, light weight, and ease of manufacture of all parts except the projectile were obviously in favor of the Brandt mortar, and after service test it was adopted as standard.

THE 60-MM. MORTAR

Thus far this discussion has been devoted to trench mortars of approximately the size of the 3-inch Stokes. It is not intended, however, to convey the impression that other sizes do not exist. Mortars from 3-inch to 240-mm. in size actually were used during the World War, and an experimental 11-inch Sutton mortar was almost ready for service when the Armistice was signed. Postwar requirements of the Caliber Board included a 6-inch mortar. The desired characteristics provided that it should shoot a 50-pound projectile to a maximum range of 4,000 yards. The requirements proved too severe. A rifled mortar firing a projectile with an initial velocity of 750 feet per second was necessary, and the resulting matériel was much too heavy and immobile to perform the missions desired of it. A 120-mm. mortar finally was manufactured to meet these requirements, but in 1938 the using arms indicated that there was no longer any need for this item, and no further development is contemplated.



ONE MAN CAN PACK THE 60-MM. MORTAR

The necessity for sizes smaller than the 81-mm. mortar gave rise to the purchase and test of similar mortars of 47-mm. and 60-mm. caliber. Although the Cavalry has many uses for the 81-mm. mortar, numerous missions can be accomplished more suitably with a smaller weapon. The Infantry, too, expressed a desire for a lighter mortar. It was decided that the 60-mm. Brandt mortar was the most suitable weapon, and both branches agreed to its adoption in 1938. It has been pointed out time and again that the mortar found but little use once the stalemate was broken in 1918. During the movement toward the Rhine in October of that year, it became difficult to keep the Stokes mortars up with the advancing infantry and almost impossible to supply the mortars with ammunition. It seems obvious that the increased mobility of the 60-mm. mortar, with an ammunition supply of 4 to 1 and a weight less than one-third that of the old Stokes mortar, will open up a new field for the use of this type of weapon to in-

crease the fire power of a unit during movement.

The results obtained with the ammunition for both the 60-mm. and 81-mm. mortars were rather disappointing. Even after thorough investigation by the Brandt Company, neither the functioning nor the accuracy was satisfactory to the using arms. Furthermore, the French sights were not considered comparable to those which were standard for other weapons of our service. Consequently, the ammunition components were completely redesigned, and a new sight was built suitable for use on either mortar. Highly successful firings were conducted after the incorporation of these changes. The Ordnance Department is now licensed by the Brandt Company, and our Army is being rapidly equipped with American-made Brandt mortars, designated as the 81-mm. mortar M1, with mount M1, and the 60-mm. mortar M2, with its M2 mount (see accompanying illustrations).

THE 81-MM. MORTAR

Complete sets of standard Ordnance Department drawings for both mortars have been completed, manufacturing specifications published, difficulties in manufacture overcome, and the weapons now are being procured in quantity. In connection with the production engineering of these plans, much credit is due the American Society of Mechanical Engineers for its coöperation. At the request of Maj. Gen. C. M. Wesson, Chief of Ordnance, a special A.S.M.E. committee was appointed to study the manufacturing problems involved. The recommendations of this committee were highly valuable in planning for large-scale manufacture. While this particular instance is noteworthy, it is emphasized because it is typical of the coöperation which, under many forms, the Ordnance Department is constantly receiving from the national technical societies and from industry in general.

Facilities for the manufacture of both the 60-mm. and 81-mm. mortars are available at Watervliet Arsenal, Watervliet, N. Y. It was here, at the cannon-manufacturing arsenal, that the details of construction were worked out and trial quantities manufactured preparatory to plans for production on a large scale. In addition, appreciable numbers of the 60-mm. mortar now are being manufactured by the Read Machinery Company of York, Pa., and of the 81-mm. mortar by the A. B. Farquhar Company, Limited, also of York. A point of interest to the cannon makers at Watervliet was the difference in fundamental dimensions as compared with cannon. A 3-inch gun is made with the bore diameter three inches between lands, plus manufacturing tolerance. The projectile is made enough smaller so that it can pass through the gun. In the case of the trench mortar, however, the basic dimension is that of the projectile, and the bore of the mortar tube is not that of the nominal size of the mortar but is somewhat greater. In the 60-mm. mortar, for example, the bore diameter is 60.75 mm. In the case of the Stokes mortar, the bore diameter was about 3.2 inches.

PACKING THE 81-MM. MORTAR TUBE

The manufacturing problems connected with the production of our standard mortars are not difficult. Any modern machine shop accustomed to work within reasonable tolerances should be able to handle the machine work. However, corrosion-resisting steels have been selected for many of the exposed parts, including the elevating and traversing screws, and allowances will have to be made for the additional difficulty and time normally encountered in machining these steels. The mortar tubes themselves can conveniently be made from heat-treated seamless steel tubing. It was felt not long ago that tubing might go out of round after machining operations or during proof firing. This was not the case, however, and many mortar tubes of seamless tubing are now in service. In at least one shop, the bores of the tubes are first roughed out by the use of wood-packed reamers and then are honed to finished size. Here, as in the manufacture of most gun bores, the honing machine has replaced older methods because of the time that can

be saved and because of the fine finish that can be produced within such limited tolerances. Early difficulties which were encountered in finishing the base-cap thread on the tube within necessary tolerances have been overcome by grinding the threads from the solid. The outer surfaces of the tubes are finished on a centerless grinder. Stamping and welding facilities are necessary for the manufacture of the base plate. The body of the base plate is a stamping made from commercial low-alloy structural steel. Rigidity is obtained by welding ribs to the under side of the plate.

The characteristics of these new mortars are shown in the accompanying table. These are ample evidence to sum up the improvements embodied in the up-to-date weapons which the Infantry and the Cavalry need, and with which they are rapidly being equipped. Both mortars are simple, easy to make and to maintain, and yet sufficiently rugged for the most arduous campaign. Both are light enough to assure maximum mobility on any mission. Whether the range be long or short, or the reverse slopes sharp or gentle, a choice is offered of a projectile suitable for its target; and the chosen projectiles can be fired with rapidity and accuracy. In short, trench mortars are now available for the ideal performance of their principal mission—the close support of the rifle companies.

THE 60-MM. MORTAR WITH AMMUNITION

TRENCH MORTARS

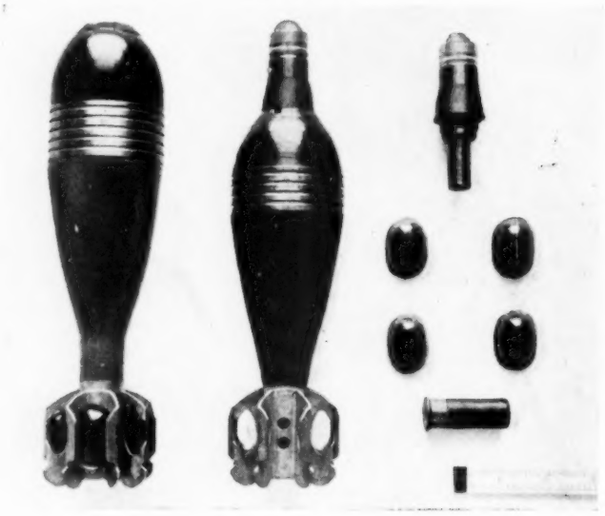
	3-inch Stokes	*60-mm. M2*	*81-mm. M1*
Weight of projectile (lbs.)	12	3	7.6 and 14.5*
Minimum range (yds.)	150	100	100 and 100
Maximum range (yds.)	750	1,750	3,280 and 1,280
Minimum elevation (deg.)	+40	+45	+45
Maximum elevation (deg.)	+75	+85	+80
Weight of tube (lbs.)	43	12	44.5
Weight of bipod (lbs.)	37	16	46
Weight of base plate (lbs.)	30	10.3	43.5
Weight in firing position (lbs.)	110	39	134

*Two projectiles are provided. Corresponding ranges are shown under respective weights.

TRENCH MORTAR CHARACTERISTICS

Specifications of the 3-inch, 60-mm., and 81-mm. mortars.

EDITOR'S NOTE.—Apropos of Captain Martin's emphasis upon manufacturing technique and production engineering of trench mortars and their ammunition, a statement published in ARMY ORDNANCE more than a year ago is in point. We refer to an article entitled, "Artillery Ammunition Production," by Lieut. Col. Levin H. Campbell, Jr. In that article (March-April 1939, Vol. XIX, No. 113, p. 273) Colonel Campbell described the processes and technique in use at the Frankford Arsenal in their relation to trench-mortar shells. He stressed the fact that production is the main obligation in time of war. He took as an example the application of production engineering to the 81-mm. trench-mortar shell. He wrote: "This is a shell susceptible of quantity production. It is made of commercial seamless steel tubing. We think it can be made equally as well of welded tubing. The rear end of the shell is closed in by hot swaging and the front end by a cupping die set in a crank press. This method of manufacture stands in marked contrast to the method previously used, whereby a forging of an average weight of 42 pounds was purchased, although the weight of the completed shell body produced therefrom is 7.71 pounds. The weight of the tubing section is 17.25 pounds.



60-MM. MORTAR SHELL, FUZE, AND INCREMENTS

Unfuzed steel shell at left, fuzed cast-iron shell at right.

"The terrific amount of unnecessary labor in making the steel, transporting it, and cutting off the excess, needs but little comment when we are speaking of quantities to be met with in time of war. The maximum machine-tool load is correspondingly reduced. And make no mistake, the machine-tool load is one of the knottiest problems confronting the Ordnance Department for its initial plunge into production. Anything we can do to lessen the machine-tool requirement by simplifying our product is a great step forward."

Gas Defense

THE United States Army must be able to oppose effectively any enemy using gas in warfare. This means, first of all, that the Army must be provided with the most efficient gas-defense equipment that modern science can devise. It means, secondly, that our armed forces must be trained in the effective employment of this protective equipment. fidence in the gas mask and other protective equipment used to shield the soldier from war gases. Good gas discipline not only spells lessened gas casualties; it insures ability to move on a military objective according to schedule even in the face of sustained hostile gas operations. The increasing ranges of military aviation and the power of aircraft to lay down

For both equipment and training in defense against gas the Army looks to the Chemical Warfare Service. This branch is charged under the National Defense Act with the development, production, and supply of all items that pertain to chemical warfare. It also is responsible for standardizing the training in gas defense throughout the service, and for developing competent instructors in this type of military technique.

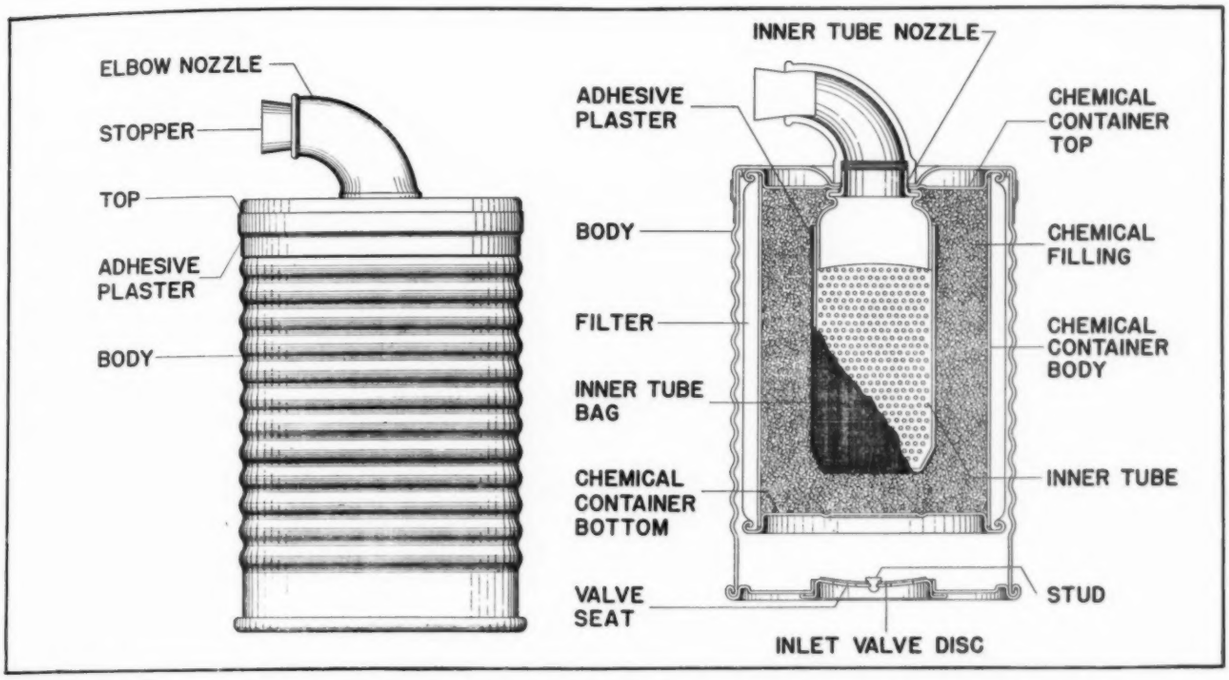
The effectiveness of any gas attack is inversely proportional to the gas discipline of the unit which is attacked—and gas discipline is developed by training based on con- effective concentrations of war gases require that gas discipline and means of protection be extended to the civilian population, especially in vital industrial areas and localities adjacent to military objectives.

No form of enemy action can be countered quite so inexpensively as the gas attack. Yet lack of adequate gas-defense equipment is certain invitation for an enemy to initiate chemical warfare. In these pages are shown types of equipment which the U. S. Army believes will prove effective in meeting and discouraging any hostile gas attack. The illustration above shows developments in postwar gas masks.

The Service Gas Mask In Production

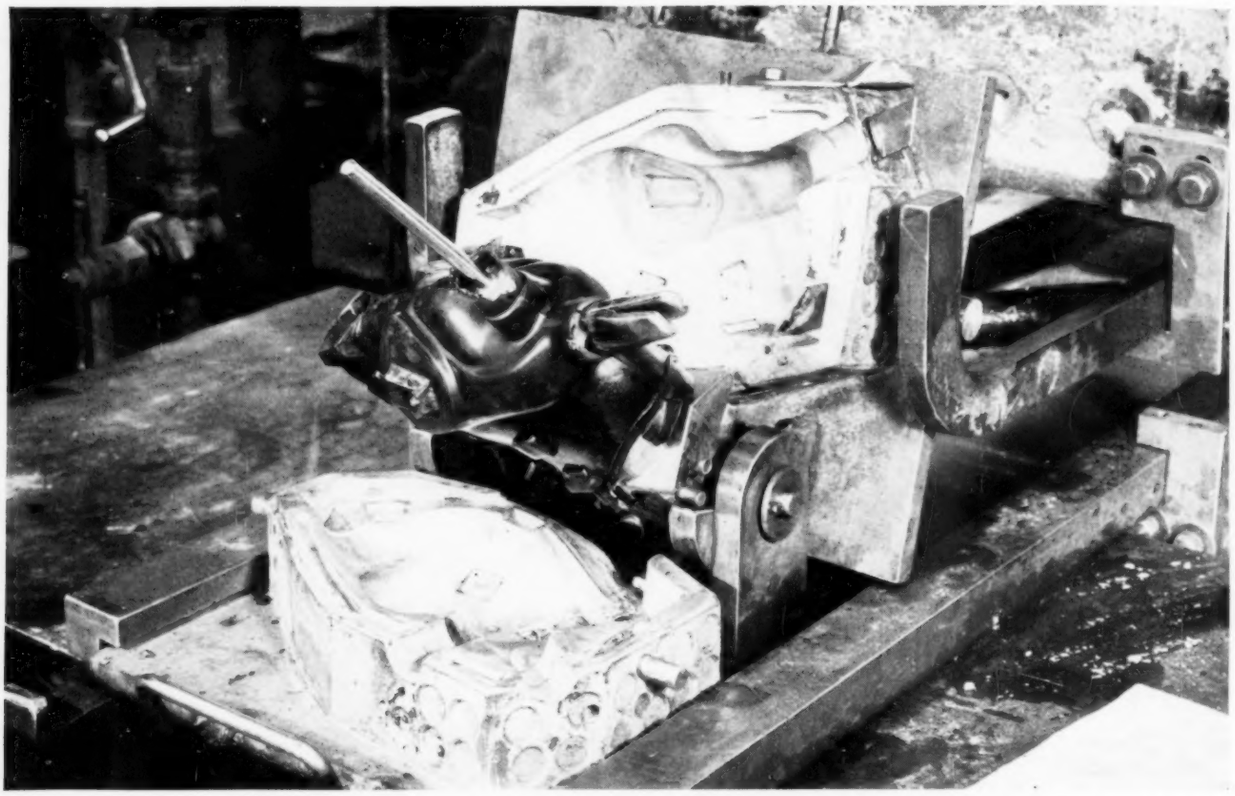
The U. S. Army service mask (left, above) will protect the wearer from all known war gases. The diaphragm mask, right, makes it possible for the wearer's voice to be heard. Below is a gas-mask assembly line. Assembly is the choke point of gas-mask production—more than ninety components being required to make up the completely finished service mask.

Inspection of the Mask Canister



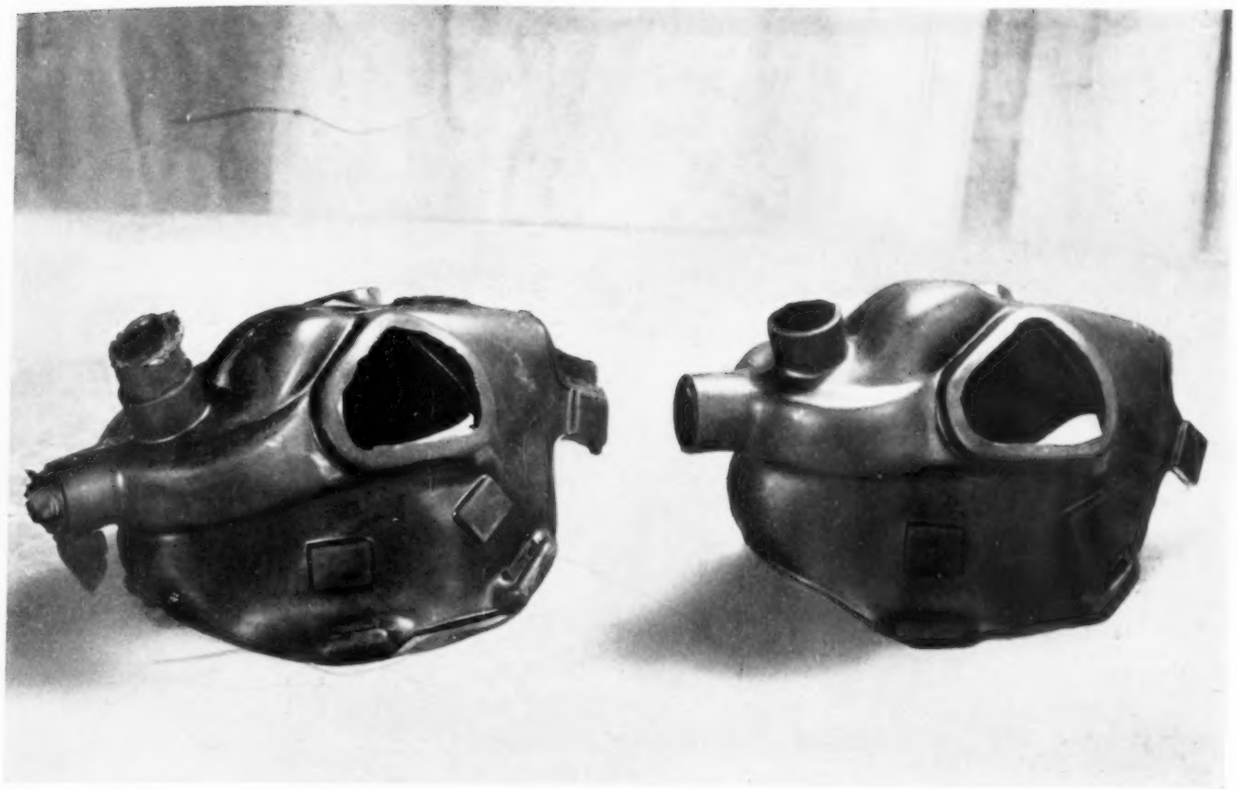
The standard gas-mask canister, exterior and in section, is shown above. It contains the filtering and purifying elements. Below, the canisters are undergoing inspection. Each stage of assembly must be inspected for extreme accuracy of workmanship. Defects of even minor nature cannot be passed, for a faulty gas mask may be worse than no mask at all.

Vulcanizing and Trimming the Rubber Faceblank



The development of fully molded rubber faceblanks for gas masks is an important advance toward quantity production of this essential defense item in emergency. A faceblank mold, above, just withdrawn from the vulcanizing press, lies open ready to be stripped. After blanks are stripped from the molds, they are trimmed and inspected as shown below.

Elements of Gas Mask Assembly



The faceblank on the left, above, has just been removed from the mold. Feather edges of rubber have been cut from the blank on the right, which now is ready for assembly. This molding is a triumph of the American rubber industry and increases both speed of production and the efficiency of the mask. Below, attaching the hose to the mask (Acme photo).

Gas Protection for Infantry and Artillery

Infantrymen, above, protected with the service gas mask, demonstrate the fire power of the Army's new semiautomatic rifle (Signal Corps photo). The gas-protected crews of a battery of modern 75-mm. guns, below, lay down a barrage to cover the advance of friendly units during recent maneuvers in field-training exercises (T. D. McAvoy photo).

Gas Defense in the Theater of Operations

Gas defense defeats one of the main purposes of hostile chemical attack; namely to make certain areas untenable by troops. Protected with masks, the crew of a modern U. S. 37-mm. antitank gun, above, goes into position on the run while, below, a machine-gun Cavalry unit, protected with masks for men and horses, advances in the face of "enemy" smoke.

Degassing Contaminated Areas

Open areas drenched with persistent gas may be made tenable by applying a mixture of bleach and sand as above. The impermeable clothing affords perfect protection to these members of a decontamination company of the Chemical Warfare Service. Concrete roads struck by gas-filled aërial bombs can be made passable by the degassing crew, as below.

Small Arms Ammunition Supply

Tactical Results with Automatic Arms Must Govern Expenditure

By Capt. Melvin M. Johnson, Jr.*

THE marked increase in automatic weapons since the World War presents a very serious problem of small-arms ammunition supply. This problem is especially grave when we consider the semiautomatic rifle—a weapon designed to replace the manually operated bolt-action repeater. Many authorities believe that due to the increased potential volume of semiautomatic-rifle fire, the soldier will quickly exhaust all available ammunition. It is the writer's purpose to present an analysis of this problem with reference to the characteristics, requirements, and tactical employment of the smaller infantry units in combat.

HERE is a timely discussion of small-arms ammunition supply by a well-qualified student of the subject. An inventor of automatic weapons, Captain Johnson has given considerable attention not only to the mechanics of ammunition supply but to the philosophy of it as well. For from time immemorial there have been military men who have held that the more mechanized—which is to say the more automatic—rifle fire becomes, the more hopeless becomes the always-complicated problem of ammunition supply. No doubt the Neanderthal man had some concentrated—albeit not deep—concern with the matter.

But as in all questions of use of a thing, there are the alternatives of conservation and waste. Now that automatic arms have brought increased fire power to the soldier the worst thing that could happen would be the calculated loss of that power by waste of ammunition. Captain Johnson's analysis has the added value of sound collateral methods which will tend to conserve the new fire power and thus lessen the dangers of too great a load on the supply organization in the field and in the factory.—EDITOR.

The following is quoted from an official test report of Lieut. J. Green, U. S. Marine Corps, addressed to Col. John Harris, Commandant, Marine Corps, under date of February 6th, *1860:* "I have seen it stated that celerity of loading and firing might be found objectionable, as the soldier would too soon expend his ammunition . . . I am fully convinced that there is no force to such an objection. The soldier in battle, possessed of a gun that can be instantly reloaded, keeping his eye on the foe, confident of his power and strength (that he is always ready), naturally is inspired with courage and self-possession which are valuable to the soldier . . . I can see no reason to justify the idea that a soldier, qualified with an arm possessing great celerity of fire, is likely to waste his ammunition at the first sight of a distant enemy . . ."

It is significant to note that this report was made on the breech-loading Sharps rifle versus the muzzle-loader. In other words, some authorities apparently had argued that the breechloader was not suitable for the soldier because it burned up too much ammunition *as compared with the muzzle-loader.* The report concludes:

"I . . . recommend its [the breechloader's] adoption to the Marine Corps, believing, as I do, that such action on the part of the Government will increase the efficiency of that force more than double its present power." (See "The Rifle in America," by Philip B. Sharpe, pp. 188-189.)

When we contemplate the history of weapons we find that the problem of ammunition supply has concerned the soldier since the advent of projectiles. In fact, supply often has figured as a deciding factor in the outcome of many important wars. We can only touch here upon small-arms ammunition and the problem of its supply to and within infantry units.

If the soldier is inclined to exhaust his ammunition by firing wildly, he can do so with the bow and the earlier rifles as well as with a semi-automatic rifle.

Armed with a common bow, the soldier, without aiming, can discharge an arrow every 3 to 5 seconds—about 12 to 20 arrows a minute, 120 to 200 arrows in 10 minutes, or 720 to 1,200 arrows an hour.

Armed with a muzzle-loading rifle, an expert can fire about 3 shots a minute—roughly about 30 shots in 10 minutes, or 180 shots an hour. Those who are familiar with muzzle-loaders may criticize these figures, yet I venture to assert that the average soldier probably could fire about two shots a minute from a rifled muzzle-loader and three to five a minute from a smooth-bore musket.

Armed with a single-shot breechloader, the average soldier probably can fire about 10 or 15 shots a minute—about 100 shots in 10 minutes, or 600 rounds an hour.

Armed with the Springfield 1903, Mauser 1898, or short, magazine, Lee-Enfield, etc., and *firing by single loading,* the average soldier probably can fire 15 or 20 shots a minute, unaimed, or 100 shots in from 5 to 7 minutes. Within 15 minutes he can fire 200 rounds, single loading.

The average soldier can discharge from 20 to 30 unaimed shots a minute from a bolt-action repeating rifle, clip-loaded. In 10 minutes he can fire 200 rounds. In an hour he can burn up 1,200 rounds—one whole case of ammunition. Armed with a conventional semiautomatic rifle, he can discharge about 50 to 60 shots a minute; in less than 5 minutes he can consume 200 to 250 rounds; in less than 10 minutes some 450 rounds, and so on.

The soldier can damage the supply system more seriously by throwing away burdensome items in his pack. He can drop his extra shoes in the ditch, as well as his ammunition belts, etc.

The following table indicates the time required to fire 200 rounds of ammunition:

*Inventor of the Johnson semiautomatic rifle. Captain, U. S. Marine Corps Reserve.

Weapon	*No. of Rounds*	*Firing Time*
Bow	200 arrows	10-12 minutes
Muzzle-loader (rifle)	200 loads	60-80 minutes
Muzzle-loader (smoothbore)	200 loads	50 minutes
Breechloader (single-shot)	200 rounds	20 minutes
Springfield '03 (single-loading)	200 rounds	10-12 minutes
Springfield '03 (clip-loading)	200 rounds	6-10 minutes
Semiautomatic rifle	200 rounds	4-5 minutes

If we except the muzzle-loader, then it appears that in less than half an hour a soldier can use up 200 rounds of ammunition, regardless of the arm he is shooting. Since we expect the soldier to "carry on" for several hours, or even several days, with 100 to 200 rounds, if he is inclined to burn up his ammunition wastefully it will matter little what weapon he has. Once he is permitted to fire, then away go the arrows, bullets, or cartridges. As far as the actual prevention of fruitless firing of ammunition is concerned, the answer is found in fire control and discipline.

GENERALLY speaking, a semiautomatic rifleman can score at least twice as many hits per minute as an ordinary rifleman. One leader is essential for every seven or eight riflemen in order to insure fire control and discipline. Therefore, one leader is essential for every *four* or *five semiautomatic* riflemen. The new infantry squad provides a sergeant and a corporal for twelve men.

Not only is it necessary to group less men per leader because of the semiautomatic rifle but also because the men must be deployed with greater intervals between files due to the increased intensity of the fire brought to bear against them. Such increased deployment in turn reduces the influence which one leader can exert over an 8-man squad.

In this connection, we should consider the two basic types of infantry rifle fire—aimed and volley. We may call these the American (aimed) and the European (volley) types. The French, for example, do not emphasize individual marksmanship. French rifle units actually fire upon *areas* "infested" by the enemy, rather than upon individual targets in such areas. In direct contrast, the American soldier is trained to hit individual targets by aimed fire.

It is not within the scope of this article to discuss the merits and defects of these systems. With respect to ammunition supply, we wish to emphasize the fact that tactical results must be considered with relation to ammunition consumption. If, under the American system, the soldier is well trained as a marksman, then, as stated above, he will score at least twice or three times as many hits in the same interval of time, or the same hits in less time, armed with the semiautomatic rifle. If, under the European system, the soldier is required to cover an area with fire, armed with the semiautomatic he can cover at least two or three times the area in the same time, or the same area in less than half the time.

To conclude this phase of the discussion, it is submitted that by organization, practical disciplinary drills, and marksmanship practice (target or combat firing), the problem of ammunition wastage can be solved.

One means of guarding against profitless ammunition consumption is found in the methods of loading the magazine as well as in the capacity of the magazine itself. For example, troops can be ordered to fire by single loading at long range. The semiautomatic can be used very well as a single-loader, firing about 5 to 10 *aimed* shots per minute. Another method is to reduce the magazine capacity or to use a magazine cut-off, thus preventing the firing of too many quick shots in one burst.

IN firing the semiautomatic rifle the soldier holds the rifle to his shoulder and, having adjusted the sights, aims, then squeezes the trigger; *aims at the next target,* squeezes the trigger; aims at the third target, squeezes the trigger; and so on until there are no targets left or until his magazine is empty. Let us suppose the soldier shoots just short of the target and has no time to correct his sights: he merely aims higher while squeezing the trigger for the second shot which he can deliver instantly.

It hardly seems necessary to call attention to the importance of the semiautomatic for use against strafing airplanes. At such times a sudden, intense volume of fire—five or ten aimed rounds in a few seconds—is mandatory. This phase of antiaircraft defense was admirably treated by Col. G. M. Barnes, Ord. Dept., in his article on "Antiaircraft Armament" in the January-February 1940 issue of ARMY ORDNANCE (Vol. XX, No. 118, p. 233). Semiautomatic rifles also can be employed as light machine guns, especially in defensive positions where a larger supply of ammunition is available. In such cases, or where the tactical situation presents opportunities, a few riflemen actually can lay down a barrage. For example, suppose we expect to fire a heavy Browning on a given area. The Browning requires a 9-man squad and can normally fire about 200 to 400 shots per minute for a number of minutes. However, the Browning squad is put out of action and is no longer available. One semiautomatic rifleman can fire 40 to 60 shots per minute for a number of minutes. Nine riflemen can deliver 360 to 540 rounds per minute. Subtract the fire of two leaders, one for three men, the other for four men. Nevertheless the seven rifles, now amply controlled, can deliver 280 to 420 rounds per minute *if needed.*

Nine ordinary riflemen could deliver from 90 to 180 rounds a minute, all firing. To use the boxing analogy so ably applied to battalion combat tactics by Col. Walter Wheeler in his "Infantry Battalion in War," when the fighter has found an opening in his opponent's guard, he must deliver a *paralyzing* blow. The opening is only momentary. The boxer with the most powerful right arm can best deliver such a blow. The semiautomatic rifle doubles and even triples the soldier's knock-out power at the crucial moment.

Thus we feel justified in concluding that in actual combat the semiautomatic rifle may be called upon to fire more shots per minute but not more shots per hour or day. Why have the great leaders of history employed the offensive so often at such great day-by-day cost in men and ammunition? Because, in many instances, they sought a quick, *relatively economical decision.* Trench warfare was extravagant because it tended to prolong the conflict before reaching a decision, exhausting all supplies in the process.

ON a small scale, infantry units, fighting locally, gain or lose decisions on the same basis. For example, if one squad is prevented from advancing by superior hostile fire, it is common practice to maneuver another squad—perhaps much more frequently, a machine rifle—to a flanking position from which a few profitable bursts can be delivered and the hostile resistance broken. This procedure being so undeniably more economical than for the stalled squad to fire their rifles ineffectively for a much longer period of time, how ridiculous

it would be were we to condemn the machine rifle because it can "burn up" 60 to 100 shots per minute. Actually, the bolt-action rifles might require many more rounds to gain the same decision, if any. The problem of ammunition consumption and supply cannot be divorced from the problem of obtaining tactical results; the two are inseparable.

Two of the nine principles of war are, at first blush, inconsistent; namely, mass and economy of force. Applied to the semiautomatic-rifle ammunition-supply problem, these mean that we should and can use the same or less rounds to achieve a desired result, yet with greater intensity and more paralyzing effect at the moment of delivery.

Not infrequently we may catch an enemy column off guard; as soon as a few shots are fired the column scatters for cover. But for a few brief moments it presents a compact target. Our mission is to destroy this unit. Its successful accomplishment with an intense burst of fire lasting but a few seconds is far more economical, both as to men and ammunition, than a skirmish requiring many minutes, if not hours, and many friendly casualties.

Proper timing saves a boxer's strength and wins fights with a minimum of effort, permitting the maximum power to be applied at the crucial moment. By this means also can infantry win battles with a minimum expenditure of ammunition.

There is a definite tendency in the latest tactical organizations to include "ammunition carriers," whose duty it is to transport as much ammunition as possible within the section, platoon, and company. Usually the ammunition carrier also functions as an emergency member of the light machine-gun or machine-rifle crew.

IT is interesting to consider the fact that while there has been an increase in "ammunition-requiring" agencies, there also has been a distinct increase in ammunition-supplying agencies since the World War. Attention is called to the fact that the road nets of the world are many times greater, wider, longer, smoother, straighter; that there are many times more trucks, cars and similar transportation agencies. In addition, we have the tremendous growth of air transport. Add to these the improved media of communication (radio, etc.) and one must confess the picture is not so black as regards supply of ammunition to rifle units, as well as all other supply not specifically covered herein.

The idea of supply from the air is not new. The "Lost Battalion" received some aid, however misdirected, from aircraft. The Marine Corps used this agency in Nicaragua. The Italians used air transport for supply in Abyssinia. It is understood that our 2nd Division has successfully used this medium. And what shall we say of the German use of it!

The sum total of these supply agencies is impressive. In one aspect—the problem of ammunition supply—the effectiveness of these supply media is twofold. First, they can directly supply ammunition, and secondly, because they can keep the soldier reasonably supplied with emergency rations, etc., he can be freed to some extent from the old-fashioned heavy pack. Thus it may be possible for the soldier to increase his ammunition load at the outset.

To summarize: 1. The problem is not new. 2. Semiautomatic and automatic weapons have not initiated the alarm over cartridge supply. 3. Earlier weapons burned up ammunition very successfully. 4. We must have fire control and discipline with any weapons. 5. We should have four or five men per leader to insure fire control. 6. The magazine capacity can be reduced and single-shot loading can be required where advisable. 7. The automatics can be more effectively employed and, if so, may actually use less ammunition to gain a decision. 8. The tactical objective, rather than units of time, must be the measuring rod of ammunition consumption. 9. The tactical objective is best gained by the sudden, intense application of paralyzing fire at the crucial moment, which is usually of short duration. 10. Supply within and to the units is expedited by: ammunition carriers, improved road nets (as of 1940), increased number of trucks, cars, etc., advances in air transport, and consequent possible reductions of the soldier's pack, permitting some increase, if necessary, in ammunition load.

It is therefore submitted that the ammunition problem is far from being insurmountable, and that the price to be paid for the latest increases in the potential fire power of infantry is very cheap in terms of tactical success which is the only medium of exchange on the combat front.

EDITOR'S NOTE.—There is, of course, another phase of small-arms ammunition supply which, although not properly a part of the above discussion, is germane to a broader consideration of the entire subject. We refer not to the matter of supply in the field, which Captain Johnson has discussed above with comprehension, but to supply in the factory; *i.e.*, supply from the manufacturing standpoint.

This subject has been treated frequently in these pages. The reader is referred to the article, "Small Arms Ammunition," by Lieut. Col. R. H. Hannum, which appeared in the January-February 1939 issue (Vol. XIX, No. 112, p. 219). As a measure of the vital importance of small-arms ammunition manufacture, the following, from the official British "Textbook of Small Arms" (1929), is pertinent:

"Cheap mass production of high-class ammunition necessitates an up-to-date factory suitably laid out and equipped with special modern machinery, each item of which is peculiar to the operation it has to perform, while the necessity for strict interchangeability of components is ensured by a careful organization controlling the sequence of operations, by the maintenance of all tools and machinery in a high state of efficiency, and by the ruthless elimination of faulty material during manufacture.

"These general considerations governing cartridge manufacture have been put forward in some detail because they have an important bearing on the capacity of any nation to manufacture small-arm ammuntion in sufficient quantities in time of war. The rate at which ammunition was required during the Great War was so much in excess of peace-time requirements that it is evident that it is quite impracticable during peace time to maintain sufficient factories for a large war. On the other hand, it is clear that the manufacture of small-arm ammunition is a serious enterprise, and that any attempt to increase capacity very rapidly must be attended by considerable risk. Not only, therefore, is it essential that there should be maintained in peace time sufficient manufacturing capacity to carry on during the early stages of a war, before new factories can be equipped, but one of the clearest lessons of the Great War is that it is vital that the difficulties of manufacture should be appreciated, and that as large a nucleus as possible of staff possessing practical knowledge of manufacture should be retained in the peace-time factories available for purposes of rapid expansion."

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Month by Month

REVITALIZATION OF THE COUNCIL OF NATIONAL Defense for the current armament program by the appointment of an advisory committee of the Council for certain specific functions is a splendid step toward industrial mobilization to meet current demands. The work now being done by that genius of mass production, William S. Knudsen, president of the General Motors Corporation, and the equally important rôle of Mr. Stettinius in the mobilization of raw materials serve to emphasize the function of the Council as a coördinating and advisory agency. Be it remembered that the Council was never intended by the terms of its legislative warrant to be an operating body. As an advisory and coördinating agency it can perform a transcendent service in the present urgent undertakings.

The Council of National Defense, by the terms of the law of August 29, 1916, is composed of the Secretaries of War, Navy, Interior, Agriculture, Commerce, and Labor. The Council, among other things, is charged by law with the "coördination of industries and resources for the national security and welfare" and with the "creation of relations which will render possible in time of need the immediate concentration and utilization of the resources of the nation." The Council has been dormant since 1921; no appropriations had been made for it and no meetings had been held since that year. Its records of World War days had been transferred to the Archivist of the United States. The revitalization of the Council and the addition to it of men of action augurs well for the program on which we are now engaged.

At the moment, therefore, the most important service to be rendered by the Council's advisory committee is in the field in which Mr. Knudsen has so promptly begun to act and wherein Mr. Stettinius, with equal celerity, is in operation. The other members of the advisory committee, especially in the fields of labor and economics, will have far-reaching assignments as the program progresses. We emphasize the fields of labor and economics because labor will be expected and, indeed, must be required to give as unflinchingly and whole-heartedly of its effort to the national defense as management itself has done for many years and now is doing with increased tempo. In the field of economics the obligation also will be great. It must not be said after this present effort is completed that inflation and inordinate profits were brought about as the result of arms production. Therefore the inflation problem had best be looked at with the broadest possible vision—and promptly. There will be no room in the handling of this grave question for any theorists or crackbrained experimenters. Most certainly there is no room for anybody with a bias against any American institution.

The Army and Navy will welcome—as they have welcomed for many years—the guidance of these leaders of industry who are now to advise regarding the arms-production program. Mr. Knudsen in particular has a thorough grasp of industrial problems as they relate to the national defense. For some years past he has come to Washington annually to address Army, Navy, and Marine Corps officer students at the Army Industrial College. Last year he served on the board appointed by the War Department to advise regarding educational orders. Fortunate, indeed, is any military and naval organization which can boast, as can the Army and Navy of the United States, that on the instant of the call, the members of the advisory committee headed by those leaders of industry—Messrs. Knudsen, Stettinius and Budd—were ready to help in the tremendous job of coördination for the production of our military armament.

THE INDUSTRIAL SIDE OF DEFENSE WITHIN the Army has had the finest kind of leadership, brain power and energy from many officers of all branches for many years. But this same industrial side has never had adequate military rank—a necessity in any strong military organization. Now, above all times, this serious situation calls for a remedy. The case was stated plainly and frankly in a recent address of Col. Frederick H. Payne before the Army Industrial College in Washington. Colonel Payne, a vice-president of the Army Ordnance Association, was the Assistant Secretary of War in the Cabinet of President Hoover. On this point he said:

"The National Defense Act is due for renovation. It is a magnificent piece of legislation and has been from the very first moment of its enactment in 1916. The act of 1920 was much better. The amendments that have come since have improved it. But the original, the revision, and the amendments all have sidestepped a most important element of the smooth working of industrial-mobilization planning. . . .

"Get the picture the act had in mind: The Secretary of War was to have his two advisers: the Chief of Staff for things military; the Assistant Secretary of War for things industrial. It is not my intention to comment upon the abilities or the records of any of the men who have held these two offices. We have had some very capable Chiefs of Staff. In General Marshall we have a most capable officer. We have had some very capable Assistant Secretaries of War (present company excluded). In Mr. Johnson we have a most capable one. But having sat at the desk of the Assistant Secretary of War I realize, as only one who has held that position can realize, the necessity of a perfect balance between the military and the industrial sides of the modern military team. You know and I know that the industrial side of the picture

in the War Department has always been out of balance simply because under the terms of the National Defense Act the military side has all the rank and the industrial side has none.

"Look at your organization charts and see how many generals there are on the staff side of the picture. I am not saying, mind you, that there is a single one too many. But look on the industrial side and you can't find coördinate rank with a microscope. I eliminate, of course, the chiefs and assistant chiefs of the supply branches. I am thinking of the organizations of those two advisers to the Secretary of War which the National Defense Act provides."

THE FOLLOWING IS AN EXTRACT FROM A thought-provoking article entitled "Fixing the Blame" by David Lawrence in the *United States News,* June 14, 1940. The subject is not new to the columns of this journal.

"American public opinion has shifted so rapidly in the last few weeks that many observers regard the change as phenomenal. But it isn't. The change from a state of indifferent isolation to a state of alert awareness of the dangers that face American security is the result of a simple and natural process—the conquest of fallacy by truth.

"For several years now we have been fed fantastic propaganda about the origin of war. Sincere though misguided men among us, so-called liberals, have been insisting that only munitions makers bring on wars. Or else the contention has been seriously advanced that profiteers contrive in diabolical ways to involve our sons in war.

"The blame for the present plight of France and Britain must be placed on those statesmen who refused to face the truth and to drive fallacy to the wall. We in America contributed our share to the debacle. Even the Senate of the United States by its widely publicized munitions investigation gave credence to the doctrine that munitions making makes wars. All over the world the charges and countercharges were exploited. And what was the result? The democracies, including ourselves, stifled the making of munitions by private industry and coincidentally failed to build up the Government plants which were urged so eloquently as the proper alternative.

"What powder-making factories do we have today? We haven't a first-class plant available to make munitions. We have been misled just as were the British and French before 1937. It takes a long time to build up a supply of munitions and to develop the technique of munition making. Only last week a few of the 'educational orders' designed to give private industry the stimulus for expanding production were let by our Government. This should have been done two and three years ago.

"The same group of men who smeared the private munitions makers smeared also a President of the United States on the ground that he dragged America into war to protect our credits and trade. This libel on the character of Woodrow Wilson was widely disseminated so as to bolster the theory that wars are made for gain and not for the defense of ideals or human liberty.

"Public opinion became antiwar at the same time public opinion became antidefense. Indifference to security is inexcusable. The names of the men who have been responsible for failing to permit America's defenses to be built up should be written plainly on the tablets of American history so that this generation may know who it was that conceived the plot to weaken the war defenses of democratic nations.

"It is not too late to institute an inquiry into what influences were at work in the United States between 1934 and 1940 to sap the economic vitality of the nation on the production side and to frustrate the granting of the requests of the Army and the Navy for new weapons and adequate supplies."

The blame must be fixed!

A MUCH PUBLICIZED DEMONSTRATION OF Lester P. Barlow's liquid oxygen-carbon explosive was conducted at the Aberdeen Proving Ground, Maryland, May 25, 1940, in the presence of U. S. Senators, members of the House of Representatives, gentlemen of the press, photographers, and skeptical ordnance experts of the Army and Navy. In addition, the test was witnessed by 96 goats tethered at various distances from 200 to 1,000 feet from the 1,000-pound charge of the explosive which was detonated by the inventor.

Among many extravagant boasts it had been claimed that living tissue could not survive some peculiar vibratory action of the air waves, unknown to the laws of physics, which this Barlow concoction was alleged to bring about. It was to prove or disprove this contention that the goats (tethered) looked on. The Barlow mixture is called glmite (pronounced glimite)—a salaam to Glenn L. Martin, airplane manufacturer, on whose staff Mr. Barlow served.

Previous attempts to conduct the test at the proving ground had been delayed, first by humane societies on behalf of the goats (tethered) and later by a premature exposure of the explosive to the air. It seems that glmite works only as long as its oxygen hasn't evaporated. This may be an advantage in certain types of commercial blasting explosives. But how a substance of such a nature would ever do for military use few, except Mr. Barlow and some of his statesmen sponsors, had been able to figure out exactly. When glmite was first submitted to the Senate Committee on Military Affairs several months ago the profound Senator Nye had called in representatives of the press to watch while the minutes of the Committee meeting were burned—so great was the military secrecy of the subject! Here was an explosive so deadly it might even outlaw war!!!

Anyway, the test was held at the proving ground on May 25th. The goats were tethered, the other distinguished onlookers looked on from points of safety, the glmite was hoisted upon a pole, the still cameras clicked, the movie cameras ground, the charge was detonated. Blast meters 500 feet distant were shattered as even the skeptical ordnance engineers had said they would be. But the goats continued to nibble away at the rye of the good Maryland Free State. Not a goat (tethered) was injured. Mr. Barlow was quoted as saying: "I'm licked on it, but I had to try it to find out."

The goats, both *Homo sapiens* and *Capra hircus,* then went on about their business. The former returned to their ponderous deliberations of state. The latter (untethered), continuing to nibble the rye of the good Maryland Free State, could wag their tails and grin at the plight of the distinguished statesmen whose combined batting average as biological chemists was about equal to Mr. Barlow's.

The Test

An Editorial

THE need of the hour is armament production. Little will be accomplished in bemoaning the fact that thoughtful people have realized this need for years. Less will be accomplished by adding to the depth of the water already over the dam. As is being said on all sides, our military armament has emerged from the planning stage and is now in action. All shoulders will be put to the wheel unflinchingly, energetically and heartily.

In so doing, a people and a philosophy are being put to the test. The whims and fancies of John Q. Public are undergoing a metamorphosis. His after-dinner theories ranging from pink pacifism to blatant militarism are settling to firmer ground. His thoughts, too often shallow, are crystallizing to reality; his talking is making place for doing. Hence the first and greatest part of the present test is morale. For, never let it be forgotten, the moral is to the material as three is to one.

If we are to meet this moral test we will have to shake loose some of the shabby abandon of less urgent times. Individuals must stick to their knitting, government must quit dealing at cross-purposes. Partisanship as to the national defense must stay adjourned. Work, hard work and plenty of it, must be the rule. Theorists and dreamers must give place to men who know how to get things done and there must be no artificial obstacles thrown in the way.

A case in point was the recent indictment of a great optical instrument company on some sort of monopoly charges of a decidedly technical nature. The company is one of the basic factors of the national defense of the United States. Its officials are of the highest integrity and acumen. With that company doing its best to meet the needs of our Army and Navy, it is a distinct disservice to our national defense when some branch of the Government, apparently having not the slightest realization of the defense load, takes the untimely step to bring charges of such a nature. Our complaint against this sort of hamstringing of the production program goes into other fields as well. Every one must give up some of his prerogatives in time of even minor emergency, and this fact must be understood by the daydreamers in government.

It is not necessary to repeat in these pages, for the benefit of American industry, that the Government daydreamers are not in the Army and Navy of the United States. As much cannot be said of other agencies. If restrictive labor legislation interferes with armament production, it too must be modified to attain the end sought. The same applies to all other restrictions and inhibitions, either Congressional or executive. Let there be excess-profits taxes for all—not alone for the arms maker but for the butcher, the baker and the candlestick maker. If it were within the field of this journal to advocate, we would say let there be universal military training too! For if we are arming to protect our country we must do just that; all else is secondary.

Then we are also testing our matériel. On this score the taxpayer need have little concern. The Army and Navy are not new at this business of design and procurement of fighting equipment. It is their day's work and has been for more than a century. In their designs they must seek simplification; in their drawings they must look to producibility; in their flow sheets they must strive to bring about savings of time; in their bills of materials they must follow commercial practice. In the field of aircraft design it has been difficult for the armament engineer to keep up with the aëronautical designer. But that condition is fast being corrected, so that today we are reaching the advantageous state of building our airplanes as weapons. Now we must design the ship to fit the gun and not vice versa. Moreover with production the watchword, experimentation must become secondary in many fields. Types must be reduced in numbers especially in fighting equipment.

FINALLY there is the test of ability. Here again our citizenry can have implicit confidence in the Army, Navy, and industry of the United States. It is laughable—were it not quite so serious—to hear some hack politicians talk of our Army's shortcomings and of the Army's inability to do the job that must be done. The plain fact is that no group of men anywhere is more competent or more qualified to handle the present production program than the officers of the Army and Navy of the United States who are now engaged in it and who have been so engaged throughout their entire professional lifetimes. Of course the aid, counsel, and coöperation of the engineering professions and American industry are essential in such a program. *But there is nothing new in that.* The Army and Navy have been working in closest cooperation with industry for years. Therefore, he who says that the services have been asleep is pleading rather his own condition, for he knows not the tremendous progress along these lines which has been made by the services during the past two decades.

This progress has been achieved in the fields of planning and research on the one hand, and limited production and supply on the other. It is decidedly unfair, therefore, and frequently untrue to charge, for political or any other self-seeking purpose, that the defense services have not been awake to the military and naval needs of the times.

To be more specific, there is not in the United States today any one group of men better qualified to handle the work of military ordnance production and maintenance than the men upon whose shoulders that heavy responsibility now rests. General Wesson, Chief of Ordnance of the Army, and his staff have gone before the country time and time again to tell it of the plans, the needs and the accomplishments of the Ordnance Department. Basic in the Ordnance conception of its job is dependence upon industrial coöperation.

Having emphasized the test our armament program is now undergoing, let us also emphasize the willingness of the Army Ordnance Association to do its part. Speaking for the Association, a nation-wide society of nearly 6,000 American citizens in all walks of industry and the engineering professions, civilian and military, ARMY ORDNANCE can say with depth of pride equaled only by depth of sincerity, that all the facilities, collective and individual, of the Association are at the disposal of our Army and Navy for whatever type of service they may be called upon to render. Personal gain or convenience has no place in the picture. And the offer stands as it has stood for the past twenty years so that industrial preparedness may meet the test for which it always has been preparing itself—to guarantee the peace and security of our country, its interests, and its people. L. A. C.

Association Affairs

ELECTION OF OFFICERS

THE biennial election of officers and three national directors of the Association for terms beginning January 1, 1941, will be held by letter ballot, in accordance with the Association's constitution, on Tuesday, September 3, 1940.

A nominating committee consisting of the following members has been appointed by the president: Philip H. Gadsden, Philadelphia, chairman; Lieut. Col. C. S. Robinson, Boston; Frank J. Smith, Rochester; J. B. Doan, Cincinnati; and Col. E. B. Meissner, St. Louis. Each of these gentlemen is president of a local Post.

After the committee presents its nominations, ballots will be forwarded before July 31st to all members who are entitled to vote. Polls will close at 12 o'clock noon, September 3rd.

PITTSBURGH POST

THE largest meeting in the history of the Pittsburgh Post, Army Ordnance Association, was held at the Duquesne Club in that city on May 3, 1940. It was the customary dinner meeting sponsored jointly by the Pittsburgh Post, Army Ordnance Association, and the Pittsburgh Ordnance District Reserve officers. Maj. Gen. C. M. Wesson, Chief of Ordnance, was the guest of honor and principal speaker. Frank B. Bell, chief of the Pittsburgh Ordnance District, presided. Brig. Gen. C. T. Harris, Jr., Assistant to the Chief of Ordnance, also addressed the meeting. Seated at the speakers' table (in the order of seating) were: Col. G. Elkins Knable, treasurer, Pittsburgh Post; Alan Scaife, Gulf Oil Corporation; W. L. Monro, member, Advisory Board; Lieut. Col. S. L. Goodale, director, Pittsburgh Post; Lieut. Col. H. C. Minton, executive officer to the Chief of Ordnance; J. L. Perry, member, Advisory Board; Lieut. Col. L. A. Codd, editor, ARMY ORDNANCE; W. F. Detwiler, vice-president, Pittsburgh Post; General Wesson; Mr. Bell; General Harris; J. D. Berg, assistant district chief; Capt. R. T. Hanson, U.S.N., inspector of naval material; G. A. Blackmore, member, Advisory Board; F. J. Chesterman, member, Advisory Board; B. C. Moise, vice-president, National Tube Company; J. C. White, general manager, Pennsylvania Railroad Company.

General Wesson, in an address which was received with hearty applause, submitted a progress report on the military armament program. Speaking of the program for the fiscal year 1940, he said:

"As to the time required to complete the manufacture of this new matériel and new ammunition, deliveries are just commencing and, with the exception of a very few orders, will be completed about December 1941. The estimated percentage of completion at different periods is as follows: September 1940, 25; February 1941, 50; June 1941, 75; December 1941, 95; June 1942, 100.

"It is thus seen that it will take two years to complete 75 per cent of the program and 2½ years to complete 95 per cent. In this connection, I have taken advantage of every appropriate occasion in my appearances before various Congressional committees, at frequent War Department conferences, and in public addresses to emphasize the time factor in the production of ordnance. In general, it takes approximately one year to place orders and to get production started and a second year to finish any reasonable program. The reasons for this apparent lag are well known to this audience. But people uninformed in these matters—and they constitute the great majority of all our people—seem to think that as soon as money is appropriated the guns and ammunition come forth like rabbits from a hat. In many quarters the old exploded theory that a million men can spring to arms overnight still persists! You and I know that any such program as we are now engaged on takes *time* and yet more *time* before there are arms to spring to!"

General Harris devoted his remarks to a discussion of the progress made by the Industrial Service of the Ordnance Department of which he is head. Colonel Codd reported on the progress of the national society in the attainment of its industrial-preparedness objectives.

In the absence of Col. H. A. Gidney, president of the Post, Lieut. Col. Hugh Minton, executive officer to General Wesson and former executive officer of the Pittsburgh Ordnance District, spoke. Maj. James L. Guion, secretary of the Post, assisted by Capt. R. J. Hogan, was in general charge of arrangements. They were aided by a committee of the following officers of the Post: Colonel Gidney; O. W. Buenting and C. W. Heppenstall, vice-presidents; Col. G. M. Sixsmith, Mr. Bell, Colonel Goodale, F. A. Merrick, Mr. Detwiler and Mr. Berg, directors; and Colonel Knable, treasurer.

CINCINNATI POST

J. B. DOAN, president, Cincinnati Post, Army Ordnance Association, sounded the keynote of the annual meeting of that organization which was held at the Queen City Club, Cincinnati, May 7, 1940. This was the annual industrial-preparedness dinner meeting of the Post and the Cincinnati Ordnance District. Mr. Doan, stressing the importance of armament production at this time, said:

"In every game or contest there is a winner and a loser. Let us be so prepared that America will never be the loser, and at the same time may we pray that we never will have to exert the tremendous forces which we have created . . . that we may have continued peace in our land, that we may so conduct ourselves that we will have no foreign enemies and that we may be in a position to be helpful in restoring the world to sanity and to economic stability.

"American businessmen often have been charged with desiring war for profit's sake, but I am sure that there is no businessman in this room and that there is no sensible businessman in any part of the country who desires war. We know too well the great sacrifices many would have to make in the event of war and the economic disasters and taxes which would follow even a successful conflict."

The principal speaker at this meeting was Brig. Gen. C. T. Harris, Jr., Assistant to the Chief of Ordnance. He expressed his happiness in knowing that all companies in the district which had received educational orders were represented at the speakers' table. He paid special tribute to the machine-tool industry. "Without the tools of this industry, ordnance matériel could not be produced today," he stated. He spoke of the complexity of war—how when he entered the Army an Infantry soldier carried one weapon and walked; how today the Infantry is armed with twelve weapons and rides. Such a change in tempo puts an enormous load on industry—the load to support the fighting front as well as the home front. He expressed himself as well pleased with the coöperation of the industrial organizations of the Cincinnati Ordnance District.

Other addresses at the meeting were made by Maj. Fred A. McMahon, executive officer, Cincinnati Ordnance District; E. A. Muller, chief of the district, and Lieut. Col. L. A. Codd, editor of ARMY ORDNANCE. Following the formal addresses, questions from the floor were answered by General Harris.

Prior to dinner, a reception was held in the lounge of the Queen City Club. In the receiving line, in addition to speakers already mentioned, were Fred V. Geier, assistant district chief; L. W. Scott Alter, national director, Army Ordnance Association, and Capt. J. B. Medaris, Ord. Res., executive assistant, Cincinnati Ordnance District.

HARTFORD ORDNANCE DISTRICT

THE Hartford Ordnance District exceeded all past attendance records at its annual meeting held at the Hartford Club, May 10, 1940. Col. B. A. Franklin, chief of the district, presided. Preceding dinner, the district advisory board held its annual meeting for the discussion of problems brought to light during the past year. A full complement of advisory board members and many Reserve officers assigned to the district attended this meeting.

In the evening, more than two hundred manufacturers of the district assembled to hear Brig. Gen. C. T. Harris, Jr., Assistant to the Chief of Ordnance, discuss current problems and progress of the rearmament program. Assembled for this address were not only the leaders of industry in the Hartford area but all the Ordnance officers who have served as executive assistants in the Hartford district. They are: Col. Francis H. Miles, Jr., now commandant, Army Industrial College, Washington; Col. J. K. Clement, now executive officer, New York Ordnance District; Maj. D. G. McGregor, now on duty at Second Corps Area headquarters, New York.

Col. Frederick H. Payne, vice-president of the Army Ordnance Association and assistant chief of the Hartford Ordnance District, presented the Franklin Medal of Merit for 1940.

The recipient of the medal this year was Lieut. Col. Douglas B. Wesson, Ord. Res., chief of the General Service, Hartford Ordnance District. The citation which was read by Colonel Payne with the award of the medal called attention to Colonel Wesson's valued experience in civil life and also his service to the Hartford district organization: "He has in the last eight months earned approximately 1,000 inactive-duty credit hours in which he has been of great value and assistance to the district, and unquestionably this is one of the outstanding indications of patriotic devotion to duty that the Army has ever experienced."

At the meeting, progress reports were presented by Lieut. Col. A. L. Bausman, Ord. Res., Lieut. Col. P. W. Bidwell, Ord. Res., and Colonel Wesson. Lieut. Col. L. A. Codd, editor of ARMY ORDNANCE, also spoke.

Col. Robert Sears, executive officer of the district, was in general charge of both meetings and was received with customary enthusiasm when he spoke at the dinner.

(As this issue goes to press, word is received that Colonel Franklin died on June 16, 1940. His service was of the highest order. His loss is very great.—ED.)

WASHINGTON POST

MAJ. GEN. C. M. WESSON, Chief of Ordnance of the Army, was honored at a luncheon given by the Washington Post, Army Ordnance Association, at the Willard Hotel on May 24, 1940. In an off-record address General Wesson discussed America's national-defense program.

He was accompanied at the head table by his assistants, Brig. Gens. Earl McFarland and C. T. Harris, Jr. General Wesson was introduced to the 175 guests attending the luncheon by Col. Francis H. Miles, Jr., commandant of the Army Industrial College and president of the Post.

Others at the head table included former Representative Swagar Sherley, who was chairman of the House Appropriations Committee during the World War; Col. James H. Burns, executive officer to the Assistant Secretary of War; Col. James L. Walsh, founder and first editor of ARMY ORDNANCE; Lieut. Col. LeRoy Hodges, comptroller of the Commonwealth of Virginia; Maj. Gen. William H. Tschappat, former Chief of Ordnance; Frank B. Bell, chief of the Pittsburgh Ordnance District, and Laurence V. Benét, life member of the Association.

During a brief business session, Maj. Gen. William Crozier, Chief of Ordnance from 1901 to 1918, and now a resident of Washington, was elected a national director of the Association.

The officers of the Washington Post are: Colonel Miles, president; Col. Henry P. Erwin, vice-president; Mr. Sherley, Col. George B. McClellan, Col. Fred E. Wright, Colonel Hodges, Col. Fred. H. Wagner, Col. Hardee Chambliss, Maj. S. E. Reimel, and Capt. Philip Schwartz, directors; Lieut. Col. R. O. Eliason, secretary, and Lieut. Col. C. E. McRae, treasurer.

M. I. T. POST

THE Massachusetts Institute of Technology Post at its regular monthly meeting in March had as its speaker Prof. Tenney L. Davis of the faculty of the Institute. Professor Davis spoke on "High Explosive Bombs in Modern Warfare." He discussed the chemistry of the more important explosives as well as the uses of bombs. The meeting was well attended not only by student members but by many officers from the Watertown Arsenal and Ordnance Reserve officers.

On April 3rd, members of the Post visited the 101st Ordnance Company, Massachusetts National Guard, to witness a demonstration of the company's equipment.

The regular April meeting of the Post was held on April 11th. Prof. Earle Buckingham of the Mechanical Engineering Department of the Institute spoke on "A War Reserve of Time."

The annual election of officers of the Post was held during May. The following were installed: David McNally, president; Teddy Walkowicz, vice-president; Herbert R. Moody, secretary-treasurer; and Raymond Koch, William Cadogan, Daniel Hulett and Francis Herlihy, executive committee.

LEHIGH-BETHLEHEM POST

THE April meeting of the Lehigh-Bethlehem Post was held April 26th at the Old Sun Inn, Bethlehem, Pa. The principal business to come before the meeting was the report of the nominating committee consisting of E. G. Uhl, C. H. Carter, and A. E. Lee. Following the committee's report, the group attended in a body a lecture by Maj. George Fielding Eliot who presented an excellent analysis of the Norwegian campaign of the present war in Europe.

The annual military field day of the University was held on May 6th. One of the features of this program was the award of Army Ordnance scholarship keys. The recipients were Edward G. Uhl ('40), president of the Post, and Robert Caemmerer, a member of the executive committee of the Post.

The final meeting of the year was held May 16th at the Old Sun Inn. Following an informal supper, moving pictures of last year's R.O.T.C. camp at the Aberdeen Proving Ground, Md., and of Lehigh's military field day, May 6th, were shown. At this meeting the following officers of the Post were elected to serve until May 1941: Richard M. Shepherd, president; Lieut. Col. R. B. Gerhardt, (reëlected) first vice-president; Robert I. Felch, second vice-president; Robert Caemmerer, secretary, and Leonard J. McKinley, treasurer.

NEW YORK POST

THE annual election of officers of the New York Post was held on April 15th and the following officers were elected: Brig. Gen. Samuel McRoberts, president; Col. Crosby Field, first vice-president; Col. James E. McNary, second vice-president; R. E. Gillmor, third vice-president; Thomas E. Murray, fourth vice-president; Col. J. K. Clement, secretary, and Maj. W. John Hoffman, treasurer.

William Carter Dickerman was chosen to serve on the board of the national Association representing the Post. The executive committee consists of the above-named officers and Col. Thomas F. Brown, Maj. C. Stewart Comeaux, Mr. Dickerman, Charles J. Hardy, H. M. Tillinghast, and James R. White. The nominating committee consisted of Col. E. F. McCrossin, chairman, Lieut. Col. Charles McKnight, and W. E. Ditmars. The tellers were H. A. Campbell and James A. McDonnell.

MILWAUKEE POST

THE annual election of officers of the Milwaukee Post was held March 18th when the following were elected to serve for the coming year: Col. William W. Coleman, president; Col. E. H. Lichtenberg, vice-president; J. E. DeLong, Maj. R. S. Hoar, Maj. A. G. Peter, R. E. Friend, D. P. Davies, H. V. Kohler, H. S. Falk, M. W. Babb, and F. R. Bacon, directors; and C. W. Laumann, secretary-treasurer.

NEW ASSISTANT DISTRICT CHIEFS

THE Chief of Ordnance has announced the appointment of two new assistant district chiefs: H. C. Knowles, Cincinnati, and A. H. Brawner, San Francisco.

Mr. Knowles is general manufacturing manager of the Procter & Gamble Company, having charge of all factory operations, engineering and industrial relations, including industrial engineering and personnel activities of the company. He was graduated from the Sheffield Scientific School, Yale University, 1912, and following service with the Westinghouse Lamp Company he became chief engineer, in 1918, of American Chicle Company. In 1921 he became assistant to the general superintendent of Procter & Gamble. In his new capacity in the Ordnance district organization he will serve as assistant to Edward A. Muller, chief of the Cincinnati district.

Mr. Brawner, a native San Franciscan, was graduated from Princeton in 1922. He is treasurer of W. P. Fuller & Company with headquarters in San Francisco. Samuel Kahn is chief of the San Francisco Ordnance District. Dean Witter, a member of Witter & Company, San Francisco, also was recently appointed an assistant to Mr. Kahn (ARMY ORDNANCE, Vol. XX, No. 119, p. 326).

NEW MEMBERS

DURING the period April 1, 1940, to May 31, 1940, inclusive, the following applicants were admitted to membership in the Army Ordnance Association: Charles E. Acker, Philadelphia, Pa.; Hjalmar S. Ahlgren, Cicero, Ill.; Stanley C. Aitchison, San Francisco, Calif.; Peter P. Alexander, Clifton, Mass.; Lauson Alpaugh, High Bridge, N. J.; A. G. H. Andersen, Maspeth, N. Y.; Robert Anderson, Elkton, Md.; C. B. Andrews, High Bridge, N. J.; I. W. Andrews, Joplin, Mo.; Joseph B. Andrews, Jr., Cincinnati, Ohio; William N. Andrews, Newport, Ky.; J. B. Armitage, Wauwatosa, Wis.; Edwin E. Arnold, Pittsburgh, Pa.; K. W. Atkins, Indianapolis, Ind.

D. E. Babcock, Allenport, Pa.; A. Dudley Bach, South Boston, Mass.; William S. Baird, Berwick, Pa.; W. A. Banister, Upper Darby, Pa.; W. L. Barron, Elizabeth, N. J.; D. E. Batesole, Glenbrook, Conn.; Jerome B. Bean, Philadelphia, Pa.; H. Kirke Becker, Chicago, Ill.; J. K. Beeson, Pittsburgh, Pa.; Cecil F. Bell, Oak Park, Ill.; J. D. Berg, Pittsburgh, Pa.; W. F. B. Berger, Estabrook, Colo.; W. F. Bernstein, Chicago, Ill.; Floyd M. Blanchard, San Francisco, Calif.; Ludwig W. Blau, Houston, Tex.; Raymond C. Blaylock, Kenmore, N. Y.; Richard L. Bowron, Birmingham, Ala.; Clifton N. Bradley, Brooklyn, N. Y.; Charles E. Brinley, Philadelphia, Pa.; A. H. Bruckner, Cliffside Park, N. J.; Graham Brush, Mount Vernon, N. Y.; George N. Buffington, Barrington, Ill.; R. W. Burk, West Allis, Wis.; M. E. Burkhart, Belleville, Ill.; Horace E. Burks, Bremerton, Wash.; H. C. Butterworth, Middletown, Conn.; P. E. Butzin, Milwaukee, Wis.

Frank G. Carrington, Muskegon Heights, Mich.; D. B. Carson, Pittsburgh, Pa.; Haskell C. Carter, Portland, Ore.; J. H. Carter, Pittsburgh, Pa.; D'Arcy M. Cashin, Houston, Tex.; William L. Chandler, Knoxville, Tenn.; Albert K. Chapman, Rochester, N. Y.; D. H. Chason, Elizabeth, N. J.; G. W. Churchill, Chicago, Ill.; A. B. Cipriani, Pittsburgh, Pa.; Bruce C. Clardy, Dallas, Tex.; Donald G. Clark, McKeesport, Pa.; Edwin N. Clark, Washington, D. C.; Walter G. Clark, Los Angeles, Calif.; O. W. Clifton, Chicago, Ill.; Mitchell D. Clogg, Baltimore, Md.; James Colasanti, Pueblo, Colo.; Haldwell S. Colby, Philadelphia, Pa.; C. B. Cole, Chicago, Ill.; Charles W. Comstock, Jackson Heights, L. I., N. Y.; Alan S. Cook, West Hartford, Conn.; Earnshaw Cook, Mahwah, N. J.; Walter E. Cook, Camden, N. J.; Robert H. Coolidge, LaGrange, Ill.; Wolcott B. Crane, New York, N. Y.; R. V. Criswell, Elkton, Md.; Norman L. Crowley, New York, N. Y.

W. A. Davidson, New York, N. Y.; H. L. Day, Glenbrook, Conn.; James S. DeFrees, Cristobal, C. Z.; J. C. Dilworth, Pittsburgh, Pa.; William E. Dorman, St. Louis, Mo.; George Downing, Elkton, Md.; Claude R. Dritt, Atlanta, Ga.; G. L. Dumbauld, Pittsburgh, Pa.; Robert A. Duncan, Wyoming, Ohio; W. R. Dunlap, Pittsburgh, Pa.; Joseph E. Durham, Jr., Allentown, Pa.

Oliver H. Edwards, Cincinnati, Ohio; Max Eichschmidt, Elkton, Md.; A. B. Einig, Cleveland, Ohio; John D. Elder, Catonsville, Md.; T. Eserkaln, Milwaukee, Wis.; L. E. Everett, Belleville, Ill.

Walter B. Farnsworth, Monessen, Pa.; Ernest M. Fernald, Easton, Pa.; Frank O. Fernstrum, Detroit, Mich.; Alfred E. Finkl, Evanston, Ill.; Charles L. Fischer, St. Louis, Mo.; W. H. Fitzpatrick, Meriden, Conn.; Thomas F. Fleming, Jr., Chicago, Ill.; D. W. Fletcher, McKeesport, Pa.; Charles K. Flint, Rochester, N. Y.; Thomas M. M. Foote, North Muskegon, Mich.; A. A. Frymark, Chicago, Ill.; L. J. Fundis, Belleville, Ill.; Ernest W. Furnans, Jr., New Bedford, Mass.

Michael T. Gaciala, Staten Island, N. Y.; E. Gammie, Chicago, Ill.; George L. Garton, Des Moines, Iowa; William A. Gibson, Allentown, Pa.; J. E. Goble, Pittsburgh, Pa.; N. C. Goin, Pittsburgh, Pa.; Edw. K. Goldschmidt, Chicago, Ill.; H. J. Goosman, Elizabeth, N. J.; Mortimer S. Gordon, New York, N. Y.; Jess E. Goroshow, Milwaukee, Wis.; I. W. Grapp, St. Paul, Minn.; N. B. Green, Rochester, N. Y.; L. J. Gregory, Cincinnati, Ohio; George Y. Greiman, York, Pa.; Philip E. Gruber, Melrose, Mass.

Oliver S. Hagerman, New York, N. Y.; Matthew J. Hall, Jersey City, N. J.; William H. Hamrick, Niles, Ohio; Gordon D. Hardin, Louisville, Ky.; H. E. Harding, New York, N. Y.; T. J. Hargrave, Rochester, N. Y.; William H. Harman, Philadelphia, Pa.; J. R. Hartman, Cincinnati, Ohio; P. B. Harwood, Milwaukee, Wis.; Stewart S. Hathaway, New York, N. Y.; R. W. Hay, Curtis Bay, Md.; Emmett A. Hayden, San Francisco, Calif.; Edgar E. Hayes, Boston, Mass.; Myron J. Hayes, Rochester, N. Y.; William P. Hearsmann, III, Philadelphia, Pa.; Roger E. Heine, Garden City, N. Y.; Carl A. Henline, Wollaston, Mass.; Francis B. Herlihy, Roslindale, Mass.; Walter J. Herschede, Cincinnati, Ohio; H. F. Heyl, Easton, Pa.; T. J. Hilliard, Pittsburgh, Pa.; Vincent J. Himrod, Ithaca, N. Y.; Frank Hodson, New York, N. Y.; Harold K. Howe, New York, N. Y.; J. H. Howell, Cleveland, Ohio; Thomas D. Huff, Chicago, Ill.; William G. Hulbert, Easton, Pa.; W. G. Hume, Pittsburgh, Pa.; Hartley C. Humphrey, Ruxton, Md.; William B. Hurley, Detroit, Mich.

David D. Jacobus, Bernardsville, N. J.; Sigurd R. Jensen, Chicago, Ill.; E. W. Jeremias, St. Louis, Mo.; Herbert F. Jewson, Jr., Montgomery County, Pa.; Ralph P. Johnson, Philadelphia, Pa.; L. E. Joseph, Pittsburgh, Pa.

A. E. Kaiser, East Pittsburgh, Pa.; Arthur E. Kallinich, West Hartford, Conn.; Kyran F. Kane, Muskegon Heights, Mich.; Edward Kautsky, Belleville, Ill.; K. E. Keiling, New York, N. Y.; Phelps Kelley, Chicago, Ill.; Francis P. Kennedy, Relay, Md.; C. H. Kindl, Dayton, Ohio; J. W. Kinnear, Jr., Pittsburgh, Pa.; R. Korsan, Jr., St. Louis, Mo.; Edgar C. Krueger, Chicago, Ill.; J. A. Krugler, Easton, Pa.; Otto V. Kruse, Philadelphia, Pa.; L. M. Kubaugh, Akron, Ohio.

Neil C. Lamont, Ambridge, Pa.; Jack Langworthy, Mitchel Field, L. I., N. Y.; C. E. Leach, New York, N. Y.; Frank T. Legar, Birmingham, Ala.; C. H. Lehman, Pittsburgh, Pa.; E. C.

Lennon, Stamford, Conn.; Henry J. Lentzner, West Allis, Wis.; Alexander T. Leonard, San Francisco, Calif.; Austin T. Lillegren, Madison, Wis.; Carl R. Lindahl, Muskegon, Mich.; J. K. Lindsey, Muskegon, Mich.; H. A. Long, Allenport, Pa.; Hugh W. Long, Jersey City, N. J.; Frank W. Lovejoy, Rochester, N. Y.; Herbert E. Lyster, Chicago, Ill.

George M. Madole, Akron, Ohio; S. H. MacArthur, Chicago, Ill.; M. M. MacDonald, Kenton County, Ky.; L. E. MacFadyen, High Bridge, N. J.; G. G. Main, Pittsburgh, Pa.; C. B. Malone, Stamford, Conn.; J. M. Mather, San Francisco, Calif.; Robert R. Matheu, San Francisco, Calif.; W. H. Maxwell, Indianapolis, Ind.; Charles E. Mayette, Boston, Mass.; G. D. McAninch, Chicago, Ill.; S. McClements, Pittsburgh, Pa.; F. K. McCormick, East St. Louis, Ill.; Warner McLaughlin, Port Henry, N. Y.; George R. McMullen, Joplin, Mo.; Arthur J. McPherson, Sackets Harbor, N. Y.; F. W. Mesinger, Glenbrook, Conn.; Stanley J. Mikina, Wilkinsburg, Pa.; Clifford A. Miller, Springfield, Mass.; G. A. Miller, University City, Mo.; Morris F. Miller, Omaha, Nebr.; J. C. Minor, New York, N. Y.; Robert N. Moffett, Basking Ridge, N. J.; V. J. Mohlere, River Forest, Ill.; J. T. Moore, Columbus, Ohio; C. B. Morehouse, Watertown, N. Y.; J. S. Morgan, Jr., Hermosa Beach, Calif.; Ralph A. Mulford, Los Angeles, Calif.; Clarence A. Myers, Indianapolis, Ind.

S. R. Naysmith, Meriden, Conn.; Arthur E. Neumann, Chicago, Ill.; Charles Newbauer, Melrose Park, Ill.; W. M. P. Northcross, Washington, D. C.; Brownrigg L. Norton, New York, N. Y.; Carlos F. Noyes, Philadelphia, Pa.; P. F. Nydegger, Elizabeth, N. J.; Paul O'Brien, St. Louis, Mo.; C. Orville Orne, East Orange, N. J.; N. B. Ornitz, Pittsburgh, Pa.; Rudolf M. Ostermann, Chicago, Ill.

Joseph N. Paquin, Cleveland, Ohio; W. J. Peets, Elizabeth, N. J.; J. L. Perry, Pittsburgh, Pa.; R. R. Petersen, Watertown, N. Y.; T. I. Phillips, Pittsburgh, Pa.; John Prial, Elkton, Md.; Ralph A. Price, LaGrange, Ill.; Robert L. Probst, Clayton, Mo.; E. J. Protin, Allenport, Pa.; William F. Purdy, Arlington, Va.; F. J. Quail, Watertown, N. Y.

R. S. Rainey, Chicago, Ill.; L. D. Rigdon, East Pittsburgh, Pa.; H. J. Ritter, Stamford, Conn.; William T. Roach, Rochester, N. Y.; R. Robbins, East Alton, Ill.; J. Roll, Elizabeth, N. J.; Richard A. Rosskamm, Elmhurst, Ill.; T. E. Rounds, Glenbrook, Conn.

C. R. Sadler, Beaver Falls, Pa.; Archer M. Sampson, Muskegon Heights, Mich.; Michael J. Scales, Nyack, N. Y.; J. Schaefer, Elizabeth, N. J.; Herman W. Schaub, West Orange, N. J.; Rollin J. Schenk, Chicago, Ill.; William F. Schildbach, Detroit, Mich.; Norbert W. Scholle, Muskegon, Mich.; Ernst R. Schuelke, Kohler, Wis.; Norris H. Schwenk, Philadelphia, Pa.; Anton Schwister, Englewood, N. J.; R. A. Scobee, St. Louis, Mo.; Harold G. Seamans, Spring Lake, Mich.; C. C. Secrist, Chicago, Ill.; C. N. Shaffner, New York, N. Y.; D. V. Sherlock, Pittsburgh, Pa.; Ronald B. Shuman, Norman, Okla.; Charles J. Siegle, Muskegon, Mich.; Herman C. Sievers, Rochester, N. Y.; Henry Siplon, Muskegon Heights, Mich.; Edgar R. Smith, Catonsville, Md.; Louis P. Smith, Detroit, Mich.; Harold R. Smithson, West Chester, Pa.; Wilson W. Smock, Philadelphia, Pa.; Q. S. Snyder, Pittsburgh, Pa.; Godfrey B. Speir, Glen Rock, N. J.; Frank W. Steere, Pontiac, Mich.; Adam M. Steever, Blue Island, Ill.; Ernest J. Steffens, Roselle, N. J.; John A. Stever, South Pasadena, Calif.; James A. Stillman, New York, N. Y.; William P. Stout, Muskegon, Mich.; William L. Stribley, Grand Haven, Mich.; George A. Strom, Wheaton, Ill.; Frank O. Strowger, Rochester, N. Y.; Lester E. Swinehart, Bryn Mawr, Pa.; Alexander Szabo, Metuchen, N. J.

Walter L. Tann, Milford, Conn.; James Tate, Milwaukee, Wis.; William J. Tepsic, Pittsburgh, Pa.; Burson Treadwell, Dayton, Ohio; E. W. Trecker, West Allis, Wis.; F. J. Trecker, West Allis, Wis.; Richard Treiber, Oak Park, Ill.; James W. Tull, Washington, D. C.

Ronald W. Updike, Indianapolis, Ind.; Chester J. Van Damn, Muskegon Heights, Mich.; B. J. Victor, Chicago, Ill.; George E. Victor, Chicago, Ill.; John H. Victor, Chicago, Ill.; W. F. Victor, Chicago, Ill.; R. E. Vom Lehn, Elizabeth, N. J.; F. W. Vorck, Wellesley Hills, Mass.

Teddy F. Walkowicz, Cambridge, Mass.; J. Roy Walraven, Atlanta, Ga.; C. A. Wattson, Stamford, Conn.; George A. Weber, West Allis, Wis.; Orin A. Weiss, New York, N. Y.; Frederick A. Weymouth, Pittsburgh, Pa.; Byron W. Wheeler, Jr., Derby, Conn.; W. G. Wilkins, East St. Louis, Ill.; C. T. Willard, Elizabeth, N. J.; George W. Williams, Trenton, N. J.; Victor G. Willis, Elkton, Md.; O. P. Wilson, Stamford, Conn.; Gunnar A. F. Winckler, Elkton, Md.; Garrard Winston, New York, N. Y.; William H. Winterrowd, Philadelphia, Pa.; W. P. Witherow, Pittsburgh, Pa.; Robert S. Wolfsohn, Waterbury, Conn.; G. V. Wood, San Francisco, Calif.; F. L. Wright, Stamford, Conn.; Robert R. Wyker, Huntington Park, Calif.; J. K. Young, Meriden, Conn.; M. E. Zimmerer, Kokomo, Ind.

NECROLOGY

WALTER J. KOHLER, industrialist, philanthropist, former governor of Wisconsin and charter member of the Army Ordnance Association, died April 21, 1940. His loss to the Ordnance cause is no less great than it is to the many civic, charitable and public-spirited enterprises with which he had been connected. He was one of the first to enroll in the Army Ordnance Association in October 1919. The plants of the company were closed following his death out of respect to the Austrian immigrant's son who, at the age of 15, began as a laborer at $1.25 a day to become a leading manufacturer and Wisconsin's governor in 1929 and 1930.

The model industrial village of Kohler, Wis., with its 3,700 employees, paid homage to the man who was president of the company from 1905 to 1937 and chairman of the board from 1937 until his death.

Governor Kohler's life was replete with achievement. Little wonder that his interest in armament preparedness was untiring. His industrial service during the World War and the zeal he always displayed for the national defense are an inspiring part of a typically American record of success.

SHIERFIELD G. MYERS of the Sperry Gyroscope Company died in Oceanside, N. Y., on May 3, 1940. Mr. Myers, long a member of the Army Ordnance Association, was an outstanding authority on antiaircraft fire control.

He was associated with the Sperry Company from 1915. His early engineering work was concerned with the gyrostabilizer, and during these years he was actively associated with the U. S. Navy. He traveled with the fleet on the destroyer OSBORNE for three winters, observing the operation of her gyrostabilizer, into which he incorporated many improvements. Later, he went to England to supervise the service testing of the stabilizer on the British destroyer VIVIEN.

In 1927, Maj. William P. Wilson of the Ordnance Department completed the design and manufacture of the first antiaircraft director in this country. He died November 29, 1927, and Maj. Gen. C. C. Williams, then Chief of Ordnance, called upon the Sperry Company to undertake further development of Major Wilson's pilot model and to construct a second model. Mr. Myers played a prominent part in the design of this second model, which became known as the antiaircraft director T4 and which was the forerunner of several later standardized models. From that time until his death, Mr. Myers devoted his entire time to the design of fire-control matériel. The present type of antiaircraft director now used in the services is in large measure the result of his efforts.

Mr. Myers was well known in the Army Ordnance Association, where his passing will be regretted by his many friends.

LIEUT. COL. CHARLES DEMONET, second vice-president of the Washington Post, Army Ordnance Association, died in Washington on April 14, 1940. He was a charter member of the society and had served frequently on its various committees. During the World War he was commissioned a captain in the Ordnance Department and was assigned to positions of responsibility in the Ordnance Field Service. He served several tours as president of the District of Columbia Military Training Camps Association and frequently managed the campaigns for C.M.T.C. recruits.

The staff of ARMY ORDNANCE especially regrets his passing away. He was a frequent visitor and counselor and always displayed the highest qualities of an officer and gentleman.

FREDERICK L. CRANFORD, of Brooklyn, N. Y., a charter member of the Association, died March 29, 1940. During the World War he served as director of construction of Government nitrate plants and for a time was in charge of construction work at the nitrate plants at Muscle Shoals, Ala. He also served in an advisory capacity in the erection of nitrate plants at Toledo and Cincinnati, Ohio. In these capacities he was closely associated with Brig. Gen. John W. Joyes, chief of the Nitrate Division, Office of the Chief of Ordnance.

Mr. Cranford was identified with many public enterprises in and about New York City. He was a member of many professional societies and served as a director and trustee of many financial institutions. In 1935 he received the annual gold medal of the Downtown Brooklyn Association for distinguished service to his borough. He was an early sponsor of New York's Tri-Borough Bridge. Companies with which he was identified constructed many of the subways in Brooklyn.

COL. BASCOM LITTLE, of Cleveland, Ohio, a charter member of the Army Ordnance Association, died May 27, 1940. He had been in ill health for several years.

Colonel Little, born in Cleveland, was graduated from Cornell University. In 1916 he was made chairman of the National Defense Committee of the United States Chamber of Commerce, having previously served as president of that body. The late Newton D. Baker, then Secretary of War, appointed him a member of the board to select a machine gun for the Army. This board was responsible for the choice of the Browning weapon. Later he was commissioned colonel in the Ordnance Reserve.

From 1919 to 1933 Colonel Little was president of Crowell & Little Construction Company, Cleveland, which erected many notable buildings particularly at Oberlin College and Cornell University. He had been a director of the Citizens Savings and Trust Company and the Union National Bank.

The memory of Colonel Little will be held in affection especially by those who served with him in the early days of the World War. At a time when controversy regarding the best type of weapon for arming our defense forces was a matter of grave national concern, he brought to the solution of that problem wise counsel and quick, practical judgment which contributed in large measure toward the satisfactory and speedy solution of the problem.

NOTICE also has been received of the death of the following members of the Association: Brig. Gen. Otto H. Falk, Milwaukee, Wis.; Harold W. Hunsiker, Reno, Nev.; W. M. Jones, New York, N. Y.; Alexander Lambert, New York, N. Y.; G. W. Pickering, Cleveland, Ohio; William D. Pierson, Waterbury, Conn.; Charles L. Rand, New York, N. Y.; W. D. Sargent, Miami Beach, Fla. To their relatives and friends, ARMY ORDNANCE, on behalf of the Association membership, extends condolences.

From the Record

The following excerpts are from the testimony of Gen. George C. Marshall, Chief of Staff of the Army, before the Subcommittee on Appropriations, United States Senate, during deliberations of the Military Establishment Appropriation Bill for 1941:

AN AIRPLANE detector is a very complex device, recently developed, that will locate a plane some distance away and follow it as long as the plane is within range of that particular device. One of the complications of the defense against aircraft has been in the matter of early detection of planes flying over water toward the land in time to permit the pursuit planes or interceptor planes to take off and reach the altitude of the bomber in time to drive it away or destroy it. Off the coast of Scotland and England, as I understand it, boats with detection devices are located for the purpose of giving warning of the approach of hostile airplanes. Such a system is very difficult to manage accurately. Our particular device will permit us to place our stations along the shore line.

The detector is complementary to the antiaircraft guns. There are three things necessary for air defense: pursuit airplanes, antiaircraft guns, and the warning devices or detectors which will give notice to pursuit aviators and to gun crews so that they will be prepared to meet the approaching hostile aircraft. The most effective protective element in the air-defense system is the pursuit plane.

THERE are eleven National Guard harbor-defense regiments. We have organized in each of them an antiaircraft battalion, so that they can be prepared to do both antiaircraft work and coast-defense work. As thus organized they could be very quickly converted into strictly antiaircraft units. That would give us a potential increase of quite a large number of antiaircraft units depending upon how many we could move away from the particular forts where their present mission holds them. We are trying in every way to find the most economical basis for national defense. We are trying to increase the National Guard components where they fit into the picture to advantage. This is particularly true with relation to antiaircraft work which requires a type of training and a type of service which differs from the requirements of the mobile army. Not so much seasoning is required in antiaircraft units as in the Infantry and Field Artillery of the Regular establishment, and such units are less expensive to maintain in the National Guard than in the Regular establishment.

Until very recently the National Guard only had ten regiments. They now have fourteen regiments and will reach nineteen during the latter part of fiscal year 1941.

COAST defense has a very definite value. Without it we would be very seriously embarrassed. With it we have a freedom of action for the fleet and for other operations that is of great importance. Panama best illustrates this: If we did not have the big coast-defense guns and a strong air force in Panama, conceivably the fleet could be bottled up and could not deploy to meet a threat from a hostile fleet. As the fleet would have to come out single file, the enemy ships could concentrate on the leading vessel and place the fleet at a fatal disadvantage if this movement were not protected by long-range guns and aircraft. However, with the coast-defense guns and the aircraft there the fleet would be protected until it was able to get into formation to protect itself to the best advantage and inflict the greatest harm on whatever enemy might be threatening. The

coast-defense guns, particularly in foul weather when the air units could not operate efficiently, would defend the coast against a raid or similar operation. Until the last few years we neglected our coast defenses largely due to the fact that we had to cut appropriations, and other requirements were of greater comparative importance.

I DO not know a better illustration of the economy and the advantages of research than in this matter of bombs. When I came to Washington a little over a year ago, it took a year to manufacture and deliver bombs in large quantities. That meant that for every plane we had to have a full war reserve of bombs on hand in time of peace, otherwise it would have been almost certain that the planes would run out of ammunition and not be able to be utilized for the purposes for which they were manufactured. So the decision was obvious that we should have sufficient bomb loads for each plane. About that time the Ordnance Department, in coöperation with industry, succeeded in developing a new process for making bomb bodies which cut the time down to eight months, and it has since been reduced to six months. The more our industry, by research, is enabled to produce munitions quickly, the lower our reserve requirements will be. I believe it is very important that we have money for research for the production in industry of certain items that are noncommercial in character.

AT THE present moment, for example, (with reference to the extrahazardous duties for certain Signal Corps and Ordnance officers) we have thirty Ordnance officers in training for duty with the Air Corps. Those men will be engaged with all matters relating to armament, many of which have hazardous aspects. For example, take the recent case of the plane in which a 75-mm. gun was installed. Testing that gun was not a normal flight, yet we asked an Ordnance officer to fly in that plane and fire the first 75-mm. gun ever fired from a plane. It was thought that the test would be successful, or we would not have permitted it, but up to the time the gun was fired no one could say what would happen. That flight was not a normal flight. In fact, it was a hazardous flight. There are a number of other things to be done in connection with the armament of planes, which produce hazardous situations. They are not normal activities of civil aviation or even of military aviation.

WE HAVE not dropped troops in parachutes in this country up to the present time. We have visualized the use of our present bombers for the transportation of parachute troops after they have been superseded by more effective bombers. We have been lacking in parachutes as a matter of fact. We now have 12,153 on hand or on order and have 2,000 in these estimates.

I THINK in relation to that [the expenditure af approximately two-thirds of Army appropriations for pay, subsistence, etc., during the period 1930-1939 inclusive] it is merely a case of the American standard of living applied to the maintenance of a volunteer army scattered over a tremendous number of small posts, not only in this country but in the Philippines, Hawaii, Panama, Puerto Rico, and Alaska. Where a foreign army may pay less than $1 a month, we have to pay, as a minimum, $21 to our man. We have to give him good food; we have to give him good medical attention . . . and we have to give him good clothes . . . We have had to maintain all these small garrisons with heat and light; and we have had to appropriate during that period about $195,000,000 for the National Guard as one citizen component. We have had to appropriate sums for the training in colleges, and for the personnel of the Army that functions in the colleges and schools, which left us but a limited sum for the very much needed matériel. I do not think there has been any waste of any kind whatsoever, except under the terms on which we have to maintain an army . . .

The Garand Rifle

There has been so much powder-smoke and "courage-to-be-frank" discussion lately about the Army's semiautomatic shoulder rifle (known as the Garand—officially designated the U. S. rifle, caliber .30, M1) that a clear restatement of the case is in order. Much of what follows has already been published in these pages. It is repeated here for the record.

THE U. S. rifle, caliber .30, M1, was originated by John C. Garand, an employee of the Ordnance Department of the U. S. Army, at the Springfield Armory, Mass., during 1929. It resulted from his experience with a caliber .276 semiautomatic weapon designed and developed shortly after the World War. The adaption of the smaller caliber design to caliber .30 was first proposed by Mr. Garand in the latter part of 1929 when the question as to the proper caliber for a semiautomatic for Army use was up for decision before the War Department.

The construction of a pilot model of the Garand rifle, as it then was called, was authorized on November 7, 1929, and an order was placed with Springfield Armory for its manufacture on November 14, 1929. This pilot was completed during the first part of October 1931, and was sent to the Aberdeen Proving Ground, Md., for test. It was fired at the proving ground on October 9 and 10, 1931, and was returned to Springfield Armory for the correction of defects which developed during the test. A second firing took place at the proving ground between February 18 and 24, 1932, and the pilot rifle was returned again to Springfield Armory for further correction of difficulties encountered.

The third test was completed on March 22, 1932, and at its conclusion instructions were given for the manufacture of eighty rifles for extended service test by the using arms. This order was placed with Springfield Armory in March 1932. The eighty rifles were completed and delivered during May 1934, fifty being sent to the Infantry Board at Fort Benning, Ga., and twenty-five to the Cavalry Board at Fort Riley, Kans., for actual service test by the Infantry and Cavalry, respectively.

The first order for eighty rifles was manufactured on a semi-production basis; that is, tools, jigs, and fixtures were designed, fabricated, and used in the construction in order to maintain interchangeability of parts. These manufacturing aids were not, however, of a type suitable for large-scale mass production.

The service tests were completed in December of that year, and the Garand rifle was officially standardized as the U. S. rifle, caliber .30, M1, during January 1936.

As soon as the new rifle was officially standardized, plans were made to put it in production at Springfield Armory on a quantity basis. This necessitated the design and manufacture of the essential dies, jigs, and fixtures, as well as the installation of the required machine tools. The first delivery of production weapons was made during September 1937 at the rate of 10 rifles per day. This rate was increased to 20 per day on March 1, 1938; to 40 per day on September 1, 1938; to 80 per day on July 1, 1939; to 100 per day on September 1, 1939, and to 200 per day on January 22, 1940—which rate is now being maintained.

THE new M1 rifle is a gas-operated, clip-fed, self-loading, shoulder weapon, slightly over nine pounds in weight. It fires the same ammunition as the U. S. rifle, caliber .30, M1903 (Springfield) and all standard U. S. caliber .30 machine guns. The ammunition is supplied in 8-round, reversible, *en bloc* clips

which are fed by hand into the magazine of the rifle. Upon being inserted, the clip depresses the follower, which, in turn, releases a catch, allowing the bolt to go forward under the action of a compressed spring, stripping the top cartridge from the clip and chambering it. When the last round in the clip is fired, the empty case is ejected; the clip also is thrown out, and the bolt is retained in the open position ready for the insertion of the next loaded clip.

The semiautomatic or autoloading action of the rifle is accomplished by a mechanical arm or "robot" called the operating rod. This component takes the place of the human arm in operating the bolt, the power being obtained from the propellent powder gases. In the conventional bolt-action rifle such as the Springfield, the bolt remains closed and locked to the receiver after the round is fired. To reload, it is necessary to grasp the bolt handle manually, raise it until the locking lugs of the bolt are disengaged from their locking recesses in the receiver, and then draw the bolt to the rear, extracting and ejecting the empty cartridge case. The bolt next is returned to its locked position by hand. At the same time, this operation chambers a new cartridge.

In the M1 rifle, this manual operation is performed automatically by the operating rod. Briefly, the cycle of operation is as follows: When the cartridge is fired, the bullet is propelled down the bore. As the rear end of the bullet reaches a position near the muzzle, the powder gases enter a chamber and impinge against a piston, driving it to the rear. This piston is at one end of and also an integral part of an operating rod. The other end of the rod contains a slotted cam, into which projects a cam-shaped extension of one of the bolt-locking lugs. In traveling to the rear, this slot cams the bolt-locking lug extension upward, rotating the bolt until the bolt-locking lugs are disengaged from their locking recesses in the receiver. The operating rod continues to the rear with the bolt which in turn extracts and ejects the empty cartridge case and cocks the hammer. During the rearward travel of the rod, a spring is compressed, thereby storing up sufficient energy to return the rod, bolt, and a new cartridge to the firing position. The only manual operations performed are those required to pull the trigger for each shot and to insert a new clip after every eighth round.

THERE are many features of the Garand model which make it stand out in comparison with other models. These include reliable functioning, general appearance, good balance, safety, and a short receiver (actually shorter than the receiver of the Springfield). A long receiver is objectionable for several reasons. In the first place, it is not conducive to good balance. If the added length extends to the rear, it interferes with proper sighting, and if it extends to the front, it either adds to the length and weight of the rifle or the barrel has to be shortened to compensate for the long receiver.

Simplicity and relative fewness of parts are conducive to ease of manufacture and maintenance, if this can be accomplished without resorting to complicated shapes. The M1 rifle has seventy-four components, including springs, screws, and pins, as compared with ninety-two for the Springfield. This reduction was made in spite of the added semiautomatic features of the new weapon.

To insure against premature discharge in the M1 rifle, the hammer is so constructed that it cannot strike the firing pin before the bolt is rotated to the fully breeched position. To provide an added safety measure, the firing pin is prevented from traveling forward until the same condition exists.

The new rifle is probably the easiest to disassemble of any military semiautomatic ever developed. A demonstration of removing its parts always evokes amazement from even the most experienced riflemen. It requires a total of about twelve seconds to remove the trigger-guard group, stock, operating rod, and the bolt.

The rear sight is entirely new in principle and is a great improvement in its field. Mounted on the back of the receiver, the aperture is close to the eye, and the longer sight radius thus provided makes better scores possible.

One of the more interesting and unique features of the rifle is the trigger-guard group, which consists of the hammer, trigger, sear, safety, and the parts which cause the weapon to function semiautomatically. In most weapons, the firing-pin blow is either directly or indirectly caused by a compressed spring, and the energy stored in the spring decreases as the firing pin moves forward. Thus, when the spring becomes fatigued, the impact on the primer is materially reduced and the result may be hangfires or misfires. In the Garand mechanism, the construction which controls the hammer is such that the leverage is increased as the hammer nears the point of impact. This tends to reduce the load on the sear, and causes the trigger to pull easily, in turn increasing the load on the firing pin at the time of firing, thus tending to prevent extrusion of the primer. This is just the reverse of the force, as applied by the spring, in the Springfield.

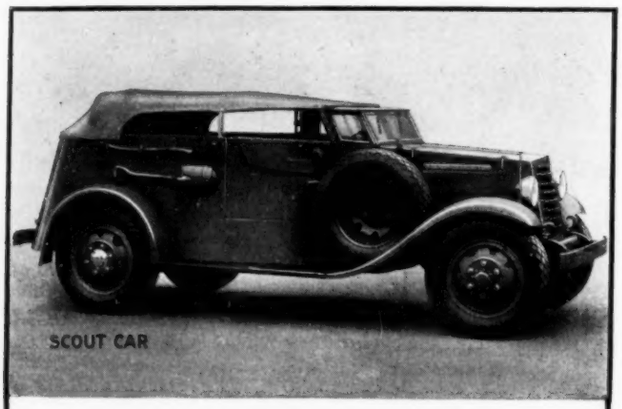
The receiver is so designed that, in the event of an accident resulting from defective ammunition, or a stoppage in the bore, the probability of serious injury to the firer is very remote. There is no danger of a bolt being blown back in the shooter's face or of gas from punctured primers being the cause of injury to his eyesight.

Some semiautomatic weapons function very satisfactorily provided the ammunition is specially adapted to the idiosyncrasies of the particular design. For example, some require that a slight film of oil or its equivalent be applied to each cartridge case before it is chambered. This is unnecessary with the M1. In fact, the weapon is quite flexible and fires high- and low-powered ammunition equally well and without the necessity of any sort of adjustment in the piece when a change is made from one type to the other.

To satisfy the requirements for a military weapon, certain exact demands had to be met. The new rifle should not weigh over nine pounds; it should be well balanced and adapted to shoulder firing; it should be simple, strong, compact, and adapted to ease of manufacture. In addition, the mechanism should be so designed as to preclude the possibility of premature unlocking, the bolt should be positively locked at the instant of firing, and the use of oil or grease applied to the cartridge case should not be necessary for proper functioning. Tests by the using services clearly showed that the M1 rifle satisfied all these requirements. It might be well to mention, in passing, that these services are not prone to "nurse" a weapon along in any test. In such cases, it is customary to issue the test weapon to all classes of soldiers from the tyro to the expert rifleman. When a test weapon receives a diploma from the school of the doughboy, it is truly fit for the wars.

IN all comparative tests between the semiautomatic and the bolt-action shoulder rifle—*i. e.*, between the M1 and the Model 1903—conducted by the Ordnance Department as well as the using services, the new rifle clearly demonstrated its marked superiority. These tests included combat and antiaircraft firing with expert, partially trained, and untrained soldiers. It generally is conceded that for short periods of fire the M1 has the value of approximately three bolt-action rifles. Many skeptics of the principle of a semiautomatic shoulder rifle have been converted by one personal experience in firing this weapon. The lack of fatigue after continuous firing and the ease with which the piece can be held on the target throughout the firing of a complete clip is remarkable for the type of fire. The average rifleman is capable of firing approximately forty shots per minute.

The rifle shows its greatest superiority over the Springfield in antiaircraft work. The so-called "kick" of the conventional, bolt-action rifle throws the line of aim well away from the target at each shot. The aim is further disturbed by manipulating the bolt for the insertion of a new cartridge. In the M1, the "kick"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is very light, and it is easy to keep the rifle on the target throughout succeeding shots. The advantage of this for defense against high-speed, low-altitude aircraft, where the target is present for a fractional period of time, can be appreciated readily. Try, for a moment, to visualize a company of soldiers on the march, equipped with semiautomatic rifles. An airplane traveling at a speed of about two hundred miles an hour suddenly appears over the tops of the trees. Within a split second, each man can bring his rifle to his shoulder and begin firing eight rounds almost as rapidly as he can pull the trigger. Defense of this type certainly should add materially to the protection of marching columns.

REPORTS to the House Appropriations Committee from Gen. George C. Marshall and commanding generals of four divisions of the Army uphold the Garand semiautomatic rifle as a superior combat weapon. The reports, based on tests by the divisions in the field, show the rifle as superior to the Springfield rifle in most cases. It was admitted that cleaning the M1 is more difficult and requires particular training.

The reports were submitted by Secretary of War Woodring to Representative E. T. Taylor, of Colorado, chairman of the House Appropriations Committee, in response to the committee's request, made as a result of certain criticism directed at the new rifle.

Concurring in the reports of the division commanders, General Marshall at the same time defended the adoption of the M2 ammunition, citing the Infantry Board's findings that the recoil of M1 ammunition in the new rifle caused excess fatigue; that the long range of the ammunition was not required for combat use, and that it was also dangerous to use since suitable target ranges could rarely be found that would protect neighboring communities.

Adoption of the M2 ammunition for light machine guns was defended on the ground that the 81-mm. mortar removes the need for long-range machine-gun fire. His report stated:

"With the advent of the infantry 81-mm. mortar, the question arose as to whether long-range machine-gun fire was necessary. Consequently, in March 1939, the Infantry Board conducted tests at Fort Benning with the 81-mm. mortar and machine guns firing both the M1 ammunition and the M2 ammunition. The board reported that adoption of M2 ammunition will reduce the effectiveness of machine guns in the following: ability to penetrate and ability to fire effectively on targets over 2,400 yards. At the same time it would permit longer life of barrels and parts, searching of more area on reverse slopes, the use of one type of caliber .30 ball cartridges in all infantry weapons and more latitude in selecting firing position.

"A statement was made that there will be rare occasions for machine guns at distant ranges and that M2 ammunition is sufficiently good in range and penetration to do the normal expected work on the battlefield. . .

"The reports from the field submitted to the committee involve forces employing 18,000 rifles which have been used in known ranges and combat practice. These reports confirm the statements of the Chief of Infantry in his letter to the Chief of Ordnance, dated April 2, 1940. Briefly, these are as follows, with confirmation noted:

"Due to increased rate of fire it can take advantage of fleeting targets which present themselves in battle. Confirmed by combat practice in divisions. The battle fire of the soldier is much more accurate due to the fact that the rifle can be held on the target and the aim not disturbed by reloading as is the case with the 1903 rifle. The fatigue of firing is very much reduced. Confirmed by all reports.

"The more rapid rate of fire and the ability to hold the piece continually on the target greatly increase the efficiency of anti-aircraft fire. This is a matter of opinion not yet based on actual target practice but confirmed by opinions by 1st Division and

6th Division. It is a reasonable assumption, as everyone knows that it is better to fire at a duck with a shotgun than a rifle. The reduced recoil and elimination of bolt manipulation in rapid fire greatly reduce the training time (about fifty per cent) required to produce an efficient rifleman. Confirmed by experience in all divisions. Offset to a minor degree in that more time is apparently needed for instruction in care and cleaning.

"The ballistic accuracy is the same as that of the 1903 rifle, but with the larger peep sight for battlefield effect, its target-range accuracy may not equal that of the 1903 rifle. Reports indicate that target-range accuracy is the same up to 500 yards, but that hits in combat practice are very much greater with the semiautomatic rifle.

"The M1 rifle has been favorably received throughout the service. This is confirmed by all reports to the effect that this rifle is definitely superior in its combat efficiency to the M1903 rifle. It also appears from these reports that all division commanders would prefer to have their troops in action equipped with the M1 rifle rather than the M1903 Springfield rifle. As one division commander states: 'The psychological effect on the increased fire power is of great combat value.' Another states that the 'U. S. infantryman would as soon think of going back to muzzle-loaders. He is now the best armed soldier in the world...'

"The Chief of Staff agrees with his commanders in the field that the adoption of the M1 caliber .30 semiautomatic rifle as a standard shoulder weapon to replace the M1903 Springfield rifle has been fully justified."

The report of Brig. Gen. Karl Truesdell, commanding the 1st Division, on comparison of combat efficiency of the Garand and Springfield rifles follows:

"Advantages—Garand: The M1 rifle has rapidity of fire which is especially valuable for antiaircraft fire, close-in aimed fire against personnel, and area fire against personnel at ranges from 500 to 1,000 yards. The recoil of the M1 rifle is so reduced that no physical injury results to the firer, and the imparting of instruction is therefore facilitated. The automatic ejection and reloading of the M1 rifle not only assists in maintaining a continuous aim but greatly reduces fatigue in the operation of the rifle. The additional three rounds in each clip provide sixty per cent more fire for the Garand before reloading is necessary.

"Advantages—1903 Springfield: For rifle competitions the Springfield, being a point weapon, is superior, particularly at ranges over 500 yards. The clips for the Springfield are lighter and are more easily handled. There are fewer maintenance problems with the 1903 rifle.

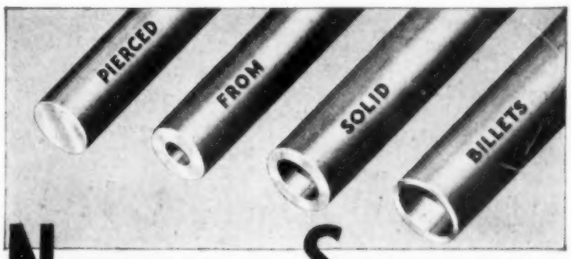
"Disadvantages—Garand: Due to the semiautomatic fire, the ammunition expenditure may be much increased. Cleaning the weapon is more difficult, and damage to the breech mechanism may result unless particular training has been given. Beyond ranges of 500 yards the weapon is not as accurate. The clip holding the cartridges must be loaded by the units and is not expendable.

"Disadvantages—1903 Springfield: The manipulation of the bolt of the Springfield causes fatigue and greatly reduces the accuracy of the firer. The manipulation of the bolt greatly reduces the effectiveness of the fire against aircraft and also the rate of fire for any target.

"The general consensus in the 1st Division is that the adoption of the Garand rifle has resulted in a distinct increase in combat efficiency."

Following is the report of Maj. Gen. W. C. Sweeney, commanding the 3rd Division:

"It is the consensus of opinion of myself, the chief of the Infantry Section, and the commanders of the 4th, 7th and 15th Infantry Regiments, that the rifle, caliber .30, M1, is greatly superior in combat efficiency to the rifle, caliber .30, Model 1903, and is a highly satisfactory infantry weapon. The 3rd Division has had a brief experience of two months with the rifle, caliber .30, M1. During this time, 3,000 men—three infantry regiments



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—fired recorded courses and combat firing and the following statistical data have been obtained which it will be observed fully substantiate the views expressed above:

"The repairs and the replacement of parts in the case of the Garand rifle have not exceeded the repairs and replacement of parts characteristic of equal quantity and variety of firing with the Springfield. While firing on the target range, failures to complete strings of rapid fire, common with the Springfield due to broken clips, did not occur with the Garand rifle. The Garand rifle is more effective in combat than the Springfield because the firer can lie motionless, whereas the firer of the Springfield has to operate the bolt, thereby moving his arm and tending to disturb his position and disclose himself to the enemy. The firer of the Springfield, even though well trained, often removes his eye from the target while operating the bolt, thereby losing time and often completely losing the target.

"With the Garand rifle it is easier for the firer to set his rear sight accurately because he does not have to remember sight corrections for the various ranges as he does with the Springfield. With the Garand rifle, lack of recoil results in less flinching and consequent increase of accuracy of fire under combat conditions. Due to greater capacity of the clips, greater ease of operation, and greater rapidity of fire, a larger volume of fire was delivered during combat practice with the Garand than with the Springfield. During combat practice, a greater percentage of hits to rounds fired was attained with the Garand than with the Springfield. The sights, both front and rear, of the Garand are superior for combat practice firing to those of the Springfield.

"The following tests were conducted under identical conditions. Two regular 8-man rifle squads were selected. One was armed with the Springfield. The targets consisted of "F" silhouettes which were moved back and forth across the front at a range of 300 yards at the speed of marching troops. Each target continued to move until it was hit and was then withdrawn. The firing was done from a kneeling position. Results were as follows:

Rifle	*Targets hit*	*Time*	*Rounds fired*
Springfield	12	1 min., 53 sec.	100
Garand	12	1 min., 21 sec.	86
Springfield	8	50 sec.	58
Garand	8	49 sec.	56

"The following is a summary of results of record firing on the known-distance range of the 7th Infantry with the Garand rifle. These results are considered satisfactory inasmuch as this regiment began its record firing within two weeks after the rifle was issued to it: Number fired, 765; number of experts, 55 (7 per cent); number of sharpshooters, 218 (29 per cent); number of marksmen, 438 (57 per cent); number unqualified, 54 (7 per cent).

"The mechanical functioning of the Garand rifle is considered satisfactory. There were a few breakages of firing pins due to a considerable amount of dry firing while training for marksmanship. Modification of training procedure reduced these breakages to a very low figure.

"From my personal observation I find that the enlisted personnel of the division armed with the new rifle find it entirely satisfactory and are greatly pleased with the results they are obtaining with it. This applies both to enlisted men of long service and to young soldiers who have only fired the Springfield one or two years. As has been mentioned above, this new weapon has been in the hands of the division for only a short period, but I think that we are all satisfied that with further opportunity to use it, the Garand will prove to be a much superior combat weapon to the old Springfield."

The report of Brig. Gen. L. R. Fredendall, chief of Infantry Section, for the 5th Division, follows:

"After observation of the firing of the Garand rifle, both on the known-distance range and on the combat-firing range, it is

my opinion that this rifle is definitely superior to the Model 1903 Springfield for combat for the following reasons: 1. The Garand rifle has reduced the time necessary to train a satisfactory military shot approximately fifty per cent. 2. Within the ranges of ordinary military combat firing, the Garand rifle is as accurate as the 1903 Springfield. 3. During critical phases of combat, the Garand rifle is capable of delivering three times the volume of effective fire of the bolt-operated weapon. 4. Men are much less fatigued after firing the semiautomatic rifle over long periods of time than they are after firing the Springfield.

"The number of malfunctions have been negligible. All Infantry company officers consulted are enthusiastic about the performance of the new type rifle."

The report of Brig. Gen. C. A. Trott, commanding the 6th Division, follows:

"The three Infantry regiments of this division have completed known-distance firing and have conducted musketry and combat firing with the Garand rifle. The few mechanical difficulties experienced were caused by lack of proper lubrication and the newness of the rifle rather than by mechanical defects. A few failures to feed or to eject properly were due to cartridge clips being worn, warped, or bent. All these defects were easily corrected. In no case was trouble experienced when a new clip was used.

"Under windy and very dusty conditions in Wyoming, the Garand rifle did not fail to fire due to sand or dust. Under the severe conditions of rapid fire, the rifle suffered fewer jams than the 1903 rifle. The recoil of the Garand rifle is much less than that of the 1903 rifle, and new men can be more easily taught in its proper use without the necessity of overcoming the tendency to flinch, as is the case with the 1903 rifle.

"The Garand rifle is a better weapon for antiaircraft fire. There is no question but that more aimed shots can be fired within a given length of time with the Garand rifle than with the 1903 rifle, thus permitting greater fire power. The individual soldier is capable of maintaining sustained fire with practically no evidence of fatigue. The unanimous opinion of the three regimental commanders and the chief of infantry section is that the combat efficiency of the Garand rifle is much greater than that of the 1903 Springfield rifle. In this I concur."

INDEX TO ARMY ORDNANCE
VOLUME XX

WITH TITLE PAGE FOR BINDING IS NOW READY

The Index is arranged alphabetically by subject and author. It includes all data published in the magazine from the July-August 1939 issue (No. 115) to and including the May-June 1940 issue (No. 120).

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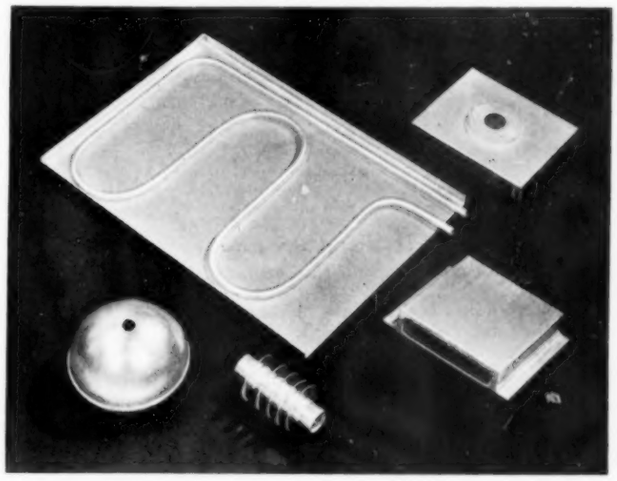

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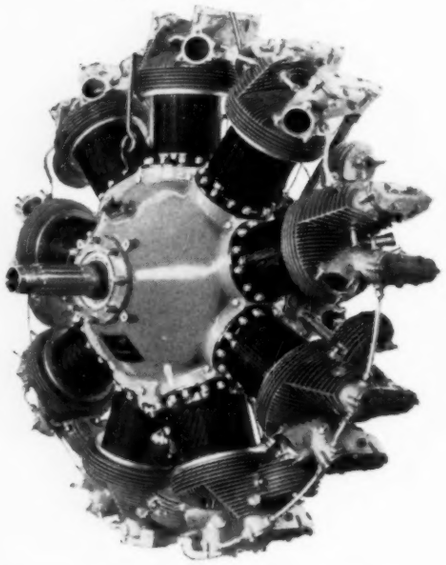

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Ordnance in Review

Recent Developments in Sporting Arms, Part IV

By Lieut. Col. Calvin Goddard, Ord. Res.

It was, I believe, Vice-President Marshall who gained immortality with the aphorism that what the average American citizen most needed was a good 5-cent cigar. Today it requires no shade from the shores of Denmark to awaken us to the fact that what the average American *marksman* most needs—in these times of steadily rising prices for machine products—are some soundly built and consistently accurate target weapons at figures within reach of the average purse.

In the small-bore revolver field, at least one manufacturer, for a decade past, has exerted highly commendable efforts to remedy this situation, with another, whose product we are about to discuss, not far behind. Indeed, judged from the standpoint of price alone (we are not now prepared to compare the virtues and defects of their respective weapons) the latter has consistently held the lead in that his offering has steadily retailed for a sum appreciably below that of his competitor. Yet both are deserving of praise for having demonstrated beyond all doubt that it is possible to build—and sell at a profit—target revolvers capable of performance equaling that of the most expensive types yet wearing price tags fully one-third lower than those displayed by their more aristocratic(?) associates.

The piece now under scrutiny is known as the "Champion Single Action Target Revolver Model 822." Carrying such a ponderous title, we might suspect it of being British; but no, it comes from the well-known firm of Iver Johnson, of Fitchburg, Mass., makers of revolvers since 1871. And though the name be a long one, it serves a real purpose for it reveals, without further ado, many of the characteristics of the weapon. Thus we learn that the lock is of the single-action variety, that the gun is designed primarily for target use, that its cylinder capacity is eight rounds, and its caliber, .22 (rim fire). Further data yielded by an examination of an actual specimen "in the flesh" include:

Barrel length, 6 inches; finish, blued; length over all, 10¾ inches; cylinder, counterbored for use of high-power ammunition; sights, Patridge type, front adjustable for elevation, rear for windage; barrel rib, matted to reduce glare; trigger pull, 2½–3 pounds and devoid of "creep"; trigger face, scored to prevent slipping; stock, one-piece, walnut, neatly hand-checked and well designed for a comfortable grip; frame, hinged or break-open type, with automatic ejection.

Another feature (peculiar to Iver Johnson products) is the adjustable finger rest which projects forward from the front face of the butt frame almost to the rear of the trigger guard, affording a comfortable support for the middle finger to nestle against as it encircles the stock. This serves the same purpose as the "grip adapters" available for attachment to certain heavy-framed weapons of other makes. In which connection it may be observed that the frame of the "Champion" is definitely *not* of the heavy type, following as it does the basic outlines of the conventional Iver Johnson pocket revolver of .32 and .38 caliber. The piece acquires weight, however, from the substantial top rib which surmounts the barrel from end to end, while the grip gains added length and girth from the solid block of walnut which not only surrounds the metal butt frame, but extends 1⅛ inches below it. The ultimate result is a weapon nicely balanced, pleasing in appearance, and with the "feel" of being neither too light nor too heavy.

The hammer (of the rebounding type) actuates a separate firing pin—a practice which this observer deprecates though he

realizes that it bears the approval of many who speak with authority. The latch (on the specimen in my possession) works smoothly and seats tight as a drum without any tendency to bind on unlatching. When the hammer was cocked eight times in succession, we found that the cylinder locked up tight in two instances, permitted just a suggestion of play in a third, and was susceptible of definite play (when rotated between thumb and forefinger) in the remaining five. This would indicate to our lay mind that the ratchet notches are not cut into the face of the ejector spider as precisely as they might have been, but the mere presence of the phenomena outlined does not necessarily mean that they influence the accuracy of the piece in the least degree.

The cylinder (which is readily detachable for inspection or

MODEL 822 IVER JOHNSON "CHAMPION" SINGLE ACTION TARGET REVOLVER

cleaning) is chamfered at its forward end, in addition to exhibiting the usual flutings between chambers. Sights are neat, substantial, and controlled by adjusting screws the slots of which are large enough to accept the bit of a man-sized screwdriver as contrasted with some I have seen which required a watchmaker's microscopic tools to negotiate.

Trigger design verges on the revolutionary—the old idea that the outline of the forward face of this member should more or less conform to that of the letter *J* having been discarded, or rather reversed. For that portion contacted by the trigger finger exhibits very plainly the contours of this consonant—*inverted* (see illustration).

COMES now the question of whether the "Champion" will "put 'em where you hold 'em." The answer is significantly illustrated by the cover design of a brochure on pistol marksmanship just released by the makers of this weapon. Here we observe that noted expert, Capt. Charles Askins, Jr., his right arm encircling a trophy, handsome in design and imposing in dimensions—the Tri-State Championship Cup—won by him with a specimen of this very model. Such a prize is attainable only by a man who can shoot straight—armed with a gun that can shoot straight.

Should further evidence of the weapon's performance be desired, however, it is a matter of common knowledge that Captain Askins has, with this same revolver, equaled the world's record (297 × 300) over the National Match course. Such scores do not happen by accident. Neither can they be compounded by one having at hand all the necessary ingredients but wanting experience in their correct admixture. This experience is a product of time and effort. But the basic elements of the formula, lacking any one of which all the experience in the world counts for naught, include a keen eye, a steady hand, and a proper "shootin' iron." The first two are variables and, as such, inject all sorts of complications into the problem. But the last is a constant—that good old mathematical *K*—solid and substantial and capable of being assigned a permanent value once it has been weighed upon the proper scales. All signs seem to indicate that the Johnson boys have produced a *K* that not only delivers the goods with commendable constancy but delivers them at minimum cost to the consumer. Bravo, Messrs. Johnson!

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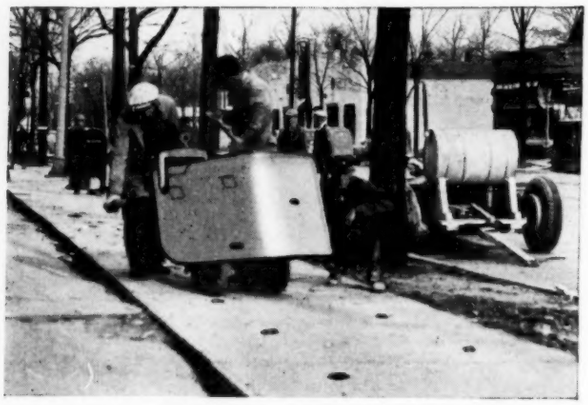

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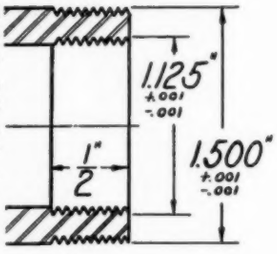

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Ordnance Reserve

SEVERAL changes affecting the status of Reserve officers have been made recently in Army Regulation No. 140-5. Pending revision of the regulations, these changes have been published in War Department circulars and probably have not come to the attention of the officers affected.

Circular No. 34, dated April 3, 1940, provides as follows: "Pending the printing of changes in AR 140-5, June 16, 1936, paragraph 74*h* is changed to *i*, and subparagraph *h* is added as follows:

"74*h*. *Incompatible vocation.*—Those Reserve officers who permanently change their vocation, profession, or technical specialty to one which does not meet the vocational requirements for promotion in their section will be required to secure a transfer, within a reasonable time, to a section appropriate to their civil occupation or be honorably discharged from the Officers' Reserve Corps. Qualified officers seeking transfer under this subparagraph may be transferred without regard to vacancies in the appropriate assignment group and will be carried as extra officers until absorbed."

A thorough study of the Reserve situation is being made in the War Department. In the course of this study it has been found that many officers have completely disassociated themselves from the occupations or professions which, under existing regulations, qualified them for the commissions and assignments which they obtained. The above change is therefore made with a view to readjustment; to placing such officers in sections where their experience and training will be of the greatest value to the service.

In order to bring the records up to date, the Ordnance Department is sending questionnaires to all officers of the Ordnance Reserve and to officers of the Specialist Reserve assigned to duty with Ordnance. Replies to these questionnaires are being carefully scrutinized, and in cases where it is found that the vocation, profession, or technical specialty of officers is incompatible with the requirements of the Ordnance Reserve, recommendation will be made that they be transferred to sections appropriate to their civil occupation.

ANOTHER change which has elicited a large number of inquiries is that published in War Department Circular No. 7, January 17, 1940, which reads as follows: "Pending the printing of changes in AR 140-5, June 16, 1936, paragraph 49*a* and *b* of those regulations is changed as follows:

"49*a*. A Reserve officer who for two succeeding years fails satisfactorily to participate in the active-duty or inactive-status training of the unit to which he is assigned or who has not satisfactorily performed the administrative duties appropriate to his assignment will be relieved from assignment. An officer relieved from assignment for this reason will either be transferred to the ineligible list for the remainder of his current 5-year appointment, without eligibility for reappointment, assignment, or promotion, or, if he has had fifteen years' commissioned service subsequent to April 6, 1917, which has previously been satisfactory, be transferred, in his current grade, to the Inactive Reserve, Officers' Reserve Corps.

"*b*. Relief from assignment, for the reason given in *a* above, in the case of officers of the grades of 2nd lieutenant to lieutenant colonel, inclusive, when assigned to regiments or to organizations of a corresponding type, will be made by the corps-area commander or the chief of arm or service having assignment jurisdiction, upon his approval of the joint (concurrent) written recommendation stating reasons for the offi-

cer's relief by the officer's regimental commander and the Regular Army unit instructor. In the case of officers of the grade of 2nd lieutenant to lieutenant colonel, inclusive, whose assignments are to units or installations not similar to the regiment, and for all colonels, relief from assignment will be made by the corps-area commander or chief of arm or service having assignment jurisdiction upon his approval of the findings of unfitness for assignment by a board of three officers appointed by the corps-area commander. At least one member of this board must be a member of the Officers' Reserve Corps, of rank equal to or higher than that of the officer being investigated, and such officer may serve on the board either in an active- or inactive-duty status. The board will investigate cases referred to it by the corps-area commander. It will make detailed findings as to the alleged unfitness for assignment of the officer concerned and, if pertinent, will make specific recommendation for his transfer to the ineligible list or to the Inactive Reserve. The officer under investigation will be given an opportunity to appear before the board in person or by brief. The proceedings of the board, together with the recommendations of the convening authority, will be forwarded to The Adjutant General who will take final action as to transfer to the ineligible list or to the Inactive Reserve."

The only new part of this regulation is that affecting Reserve officers in the grades of 1st and 2nd lieutenant. AR 140-5, dated June 16, 1936, contains these provisions in so far as officers of the grades of captain to colonel, inclusive, are concerned. A number of officers of the higher grades who have found they could not devote any appreciable amount of time to Reserve affairs because of the demands of their civil activities, have voluntarily requested transfer to the Inactive Reserve. The factor which seems to have awakened the Reserve Corps as a whole to awareness of the requirements, is that the regulation as now written affects officers of the lower grades.

ARRANGEMENTS have been made for the conduct of training courses for officers of the Arm and Service Assignment Group during the current training season.

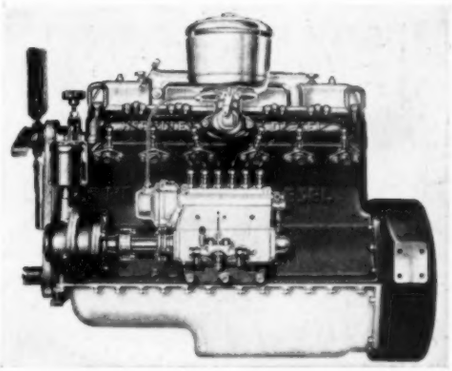
The basic inspection course will be given at University of Michigan, Ann Arbor, Mich., from August 4th to August 17th, and at Watervliet Arsenal, Watervliet, N. Y., from August 18th to August 31st. The intermediate matériel course will be given at Raritan Arsenal, Metuchen, N. J., from June 9th to June 22nd; the basic course will be given at Raritan from June 23rd to July 6th. The depot and supply course will be held at Raritan Arsenal from June 23rd to July 6th, and at Augusta Arsenal, Augusta, Ga., from August 18th to August 31st.

The advanced inspection-production course will be held at the following places: Rock Island Arsenal, Rock Island, Ill., from July 7th to July 20th—matériel covered: 3-inch antiaircraft mount M2A2 and the medium tank M2; Watertown Arsenal, Watertown, Mass., from July 14th to July 27th—matériel covered: 3-inch antiaircraft mount M2A2 and the 37-mm. antiaircraft gun carriage; Watervliet Arsenal, from August 18th to August 31st—matériel covered: cannon and breechblocks.

The proving-ground course will be held at the Aberdeen Proving Ground, Md., from July 21st to August 3rd; the staff and logistics course at the Ordnance School, Aberdeen Proving Ground, July 7th to July 20th; the loading-plant course at Picatinny Arsenal, Dover, N. J., September 9th to September 21st; and the procurement-planning course in the Office of the Assistant Secretary of War—dates to be determined.

Reserve officers of the Arm and Service Assignment Group who desire training should submit their applications to their places of assignment. War Department training policies provide that no Reserve officer, unless he is in his first year of service, who has failed to complete at least twenty-five hours of inactive-status training during the preceding year will be detailed for 14-day active duty.

H. E. A.



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Book Reviews

ROOTS OF STRATEGY—A COLLECTION OF MILITARY CLASSICS. Edited by Maj. Thomas R. Phillips, U. S. Army. Harrisburg: The Military Service Publishing Company. 448 pages. $3.

IN presenting this book, Major Phillips appears as its editor rather than its author. Yet so important is the work of selecting, cutting, analyzing, etc., and so difficult is it to arrange and annotate such a collection to its best advantage, that the thoughtful reader will give full credit to him while in no way detracting from that due the authors of the original treatises.

In his editor's foreword, Major Phillips, by his clarity of thought and facility of writing, at once shows the high caliber of his ability and the soundness of his military background. The editor's synopsis is an excellent evaluation of the five great military treatises which comprise the body of the work.

The first of these is by Sun Tzu of China. Written about 500 B. C., its fundamental value through the intervening twenty-four centuries may be approximated by the fact that it was the favorite of Field Marshal Paul von Hindenburg, whose great victory at Tannenburg so much resembles Cannae, "the perfect battle." Next is "De Re Militari" of Vegetius which was the standard text for the European soldier of the Middle Ages. There follows the "Reveries" of Marshal Saxe, the first military reformer of our era who put his thoughts on paper in connected form. It was the textbook of the great Frederick. Then comes the "Secret Instructions" of Frederick of Prussia, so well known for the past 200 years. The concluding treatise is the "Maxims of Napoleon," which shared with a New Testament and a dictionary the pocket of our own Stonewall Jackson and which is universally conceded to contain the sum of military thought up to and through the time of Bonaparte. The great *raison d'etre* of such a work as the "Roots of Strategy" is well summed up in the seventy-eighth maxim of the Emperor: "Read over and over again the campaigns of the great generals of history. This is the only way to become a great general and to master the secrets of the art of war."

At the head of each of the five treatises Major Phillips has written several pages of splendid evaluation and explanation. This greatly assists the reader to grasp the lessons of the following chapters. In these introductions he surely has mastered the art of condensed commentary. Indeed, they would form a worth-while short volume were they published alone. As it is, they make this work not only of inestimable value to the soldier, but of fascinating interest to the student of military history. The volume concludes with an index for easier reference. It is definitely not a book to be read and put aside but one to be studied and meditated upon. Its greatest lesson would seem to be the immutability of the art of war. Mechanical and tactical applications change with progress; principles never.

The concluding paragraph of Major Phillips' synopsis contains a statement which is both amazing in itself and terrifying in its implications: "This collection contains the five greatest military classics of all time. . . *All are out of print in English.*" Surely, this bodes ill for the military future of the English-speaking peoples and is a most pertinent commentary on the ghastly debacle in Europe. Major Phillips is to be congratulated for pointing the way (and providing a path) out of a morass of general ignorance. F. W. F. G.

EDITOR'S NOTE.—ARMY ORDNANCE has the good fortune to publish in this issue an article by the editor of the above volume. See "Defense Against Night Bombing", p. 24.

THE DETECTION AND IDENTIFICATION OF WAR GASES. New York: Chemical Publishing Company, Inc. 53 pages. $1.50.

THIS text is one of the series of excellent handbooks prepared by the British Government for the instruction of home-front personnel assigned to duty under the air raids precautions program. It includes brief descriptions of the standard war gases, of methods by which they may be detected; sets forth the duties of civilian gas-identification officers, and lists the sampling and testing equipment provided for their use.

Like all publications of the British Air Raids Precautions Department, this text is concise and well-written. It succeeds in presenting in relatively short space the essential data on gas identification. It presupposes however at least a bowing acquaintance with the fundamentals of chemical science.

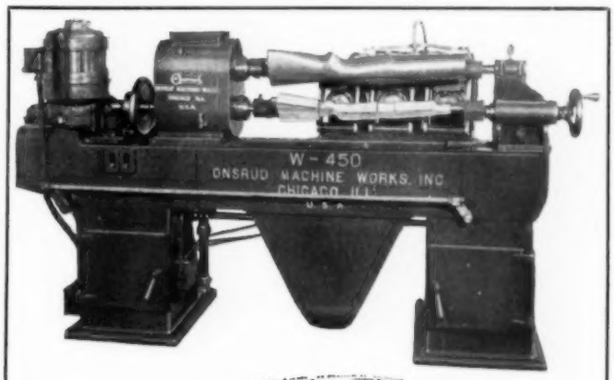
The practices approved by the British Ministry of Home Security as to defense against chemical attack are strikingly similar to the measures followed by the U. S. Army in this direction, as may be seen from study of this and other air raids precaution texts. The problem of gas detection and identification is a leading consideration in connection with any antigas program. The publication of an American edition of this handbook is timely and should be of more than passing interest to those who may be concerned with measures of civilian defense against aërial attack. G. J. B. F.

DECISIVE BATTLES. By Maj. Gen. J. F. C. Fuller. New York: Charles Scribner's Sons. 1060 pages. $4.50.

THIS is the 1-volume American edition of General Fuller's monumental analysis of the world's decisive battles B. C. 331 to A. D. 1938. The 2-volume edition published in England last year was reviewed in the January-February 1940 issue of ARMY ORDNANCE (Vol. XX, No. 118, p. 246). Military events of recent months have but accentuated the opinion expressed in these pages in the earlier review: "A careful study of General Fuller's volumes will be of inestimable value at this very moment to a bewildered world which is groping for enlightenment as to the cause and conduct of a just war. Here it will be found." Every American worthy of his salt will want to own this most timely (and most essential) analysis of the strategy and tactics of all time. Here is a guarantee—if heeded—that bungling of things military is at an end. Tragic it is indeed that General Fuller's compatriots did not have his perspective of historic fact and that they did not heed in time the implications of every chapter of this book. Once again stark tragedy comes to those who neglect the lessons of military history. L. A. C.

PERISH BY THE SWORD. By Maj. R. Ernest Dupuy, U. S. Army. Harrisburg: The Military Service Publishing Company. $2.50.

AMERICAN military history has no more extraordinary episode than the fighting of the comparatively small forces in Northern Russia and in Siberia in 1918-1919. The incredible participation of the United States Army in campaigns in Russia is associated closely with the astonishing story of the Czechoslovakian divisions in that country after the revolution. Major Dupuy tells the story of the landing of these American troops at Archangel and Vladivostok and of the subsequent operations in a manner that will greatly strengthen the opinion that foreign entanglements are good things to avoid. The story is well told and well worth knowing because of the light it throws on the achievements of our Army under most arduous and unusual conditions. Furthermore, it reveals the important and curious rôle of the American Army in helping to create the ill-fated state of Czechoslovakia. Major Dupuy's book is extremely well illustrated with interesting photographs and well-prepared maps. It will enhance his already outstanding reputation as one of the most articulate and effective writers in our army. D. A.



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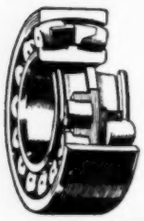

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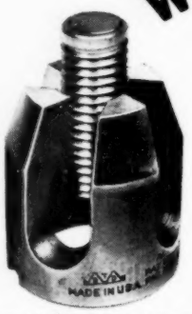

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